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AN ASSESSMENT OF THE FEDERAL NOISE RESEARCH, DEVELOPMENT AND DEMONSTRATION ACTIVITIES, FY73-FY75

Eugene E. Berkau, et al

Environmental Protection Agency
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1.0 INTRODUCTION

1.1 RESEARCH AUTHORIZATIONS IN THE NCA

The Noise Control Act (NCA) of 1972 (PL 92-574) charges EPA with the principal responsibility for implementing the policy of the Act. Section 2 states the policy intended by Congress and identifies coordination of Federal noise research as a primary means for implementation:

> "The Congress declares that it is the policy of the United States to promote an environment for all Americans free from noise that jeopardizes their health or welfare. To that end, it is the purpose of this Act to establish a means for effective coordination of Federal research and activities in noise control . . ."

The specific authorization for EPA to establish interagency noise research coordination is in Section 4(c)(1) of the Noise Control Act which reads:

> "The Administrator shall coordinate the programs of all Federal agencies relating to noise research and noise control. Each Federal agency shall upon request, furnish to the Administrator such information as he may reasonably require to determine the nature, scope, and results of the noise-research and noise-control programs of the agency."

The EPA envisions that such research coordination can provide a mechanism to aid in fulfilling its responsibilities under Section 4(c)(3) of the Act, which reads:

> "On the basis of regular consultation with appropriate Federal agencies, the Administrator shall compile and publish, from time to time, a report on the status and progress of Federal activities relating to noise-research and noise-control. This report shall describe the noise control programs of each Federal agency and assess the contributions of those programs to the Federal Government's overall efforts to control noise."

Research coordination is also the basis upon which EPA will establish the need for conducting its own research programs. These programs

should fulfill needs that are not being met through ongoing or planned programs in other Federal agencies. Section 14 reads, in part:

> "In furtherance of his responsibilities under this Act and to complement, as necessary, the noise-research programs of other Federal agencies, the Administrator is authorized to:
>
> (1) Conduct research, and finance research by contract with any person, on the effects, measurements, and control of noise, including but not limited to . . ."

1.2 FEDERAL NOISE RESEARCH COORDINATION

It is clear from Section 14, the legislative history of the NCA, and the limited funds* assigned for implementing the Act that Congress intends for EPA to utilize much of the research and technology generated by other Federal agencies to fulfill the provisions of the Act. Therefore, Federal noise research coordination is viewed as a major resource whereby EPA will achieve much of its research, development and demonstration requirements to support the regulatory and enforcement activities of the Agency.

Accordingly, EPA/ORD has developed a plan to coordinate Federally sponsored noise research, development, and demonstration activities. This plan is described in a December 14, 1973 Action Memo to the EPA Administrator and was approved for implementation on February 19, 1974. The plan (Appendix B) utilizes three interacting bodies to affect interagency coordination. These are (1) an ad hoc interagency noise research committee composed of high-level representatives of agencies with major programs in noise research; (2) four noise research panels for aircraft, surface vehicles, stationary machinery, and noise health effects; and (3) ad hoc working groups to address specific problem areas. These tools were selected to assure that EPA has continuing access to and interchange with the agencies' noise RD&D programs and projects, technology and scientific level expertise, and middle management and policy making officials.

Early in 1974 the EPA/ORD initiated Federal noise research coordination by holding a meeting of the Interagency Noise Research Committee to review and discuss the proposed coordination plan and to invite the agencies to designate representatives of their scientific and technical

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*FY 73 - $ 3,000,000
FY 74 - $ 6,000,000
FY 75 - $12,000,000

management staff concerned with noise pollution RD&D to serve as members on four noise research panels (i.e., aircraft, surface vehicles, machinery and health effects). The agencies respresented on the panels are shown in Table 1.0.

Table 1.0

STRUCTURE OF EPA RESEARCH PANELS [1]

Noise Research Panel	Current Agency Membership
Aircraft	NASA, DOT, DOD, HUD, DOC, EPA
Surface Vehicles [2]	DOT, HUD, DOD, DOC/NBS, EPA
Noise Effects	HEW, (NINDS, NIOSH, NIEHS), DOT, NSF, HUD, NASA, DOD, DOL, DOC/NBS, EPA
Machinery	HEW/NIOSH, DOI/BuMines, DOD, DOC/NBS, DOL, EPA

1 A glossary of Acronyms is contained in Appendix A.

2 This panel was also charged with the responsibility for the Federal research supporting land use policies.

In addition to exchange of information the general functions adopted by the panels in their respective areas were:

- Review and assessment of the current state of technology.
- Review and assessment of the status of research and technology development.
- Preparation of recommendations concerning ongoing research activities.
- Recommendation of noise research programs and projects, and methods for their accomplishments.
- Preparation of reports on the status and/or progress of ongoing noise research activities.

- Receipt and review of pertinent scientific and programmatic advice from communicating with other standing bodies.

The names and addresses of the Federal noise research panel members are listed in Appendix C.

1.3 PURPOSE AND SCOPE

Each of the panels agreed to generate a report on the Federal noise research, development and demonstration (RD&D) activities in the specific area of consideration by the panel. To prepare the report the EPA requested each of the panel members to provide information on their agency's noise RD&D activities. With the request EPA offered an example of the type of information desired but indicated that the information could be provided in a form most convenient to the agency (i.e., their agency's project and program information forms or overviews). Appendix D contains a copy of the EPA example and the program and project information desired. From the information provided by the Federal representatives, each of the panels has prepared a report describing the status and progress of the Federal noise RD&D activities within the panel's purview. These reports are available from EPA under the titles of:

Federal Aircraft Noise Research Development and Demonstration Programs: FY 73 - FY 75.

Federal Surface Vehicle Noise Research, Development, and Demonstration Programs: FY 73 - FY 75.

Federal Noise Effects Research: FY 73 - FY 75.

Federal Machinery Noise Research, Development, and Demonstration: FY 73 - FY 75.

In reporting the Federal noise research activities emphasis was placed on the RD&D activities in FY 73 through FY 75. Previous efforts and future projections for major programs were also presented where such information was available. Fiscal data reported was accurate as of July, 1974, but did not necessarily reflect the complete resources available for each program or project. This was principally because resources allocated to salaries, equipment, and other services for in-house studies had not been reported by all of the agencies. Because of FY 74 carryover money, the FY 74 resource allocations were best estimates in most cases, For FY 75 not only were the resources identified as estimates in most cases, but some detailed program and project planning was not complete. Therefore, the FY 75 resource estimates were also incomplete. Although it is probably unavoidable to omit some related Federal activities, it is the consensus of the panel members that no major Federal noise RD&D activities had been overlooked.

EPA has identified limits to noise exposure necessary to protect health and welfare in various environments (i.e., home, workplace, recreation, etc.) in the "Levels Document." These health and welfare goals for environmental noise control provide a basis for establishing the noise emission levels to which specific major sources of noise must be controlled. Having established the goals for source control, a basis exists for assessing the Federal RD&D programs not only with respect to the major noise sources being addressed, but also for technical approach and progress toward achievement of the goals. However, the contribution of specific major noise sources to the total noise level in the various environments and the degree of control for these major noise sources necessary to achieve the environmental goals in the "Levels Document" have not been determined. In addition, only a few of the major environmental noise sources have actually been identified by EPA as prescribed by Section 5(b) of the NCA. Therefore, the assessment of the Federal noise RD&D programs at this time is limited to a determination of the major noise source candidates and noise effects being addressed and the potential for these Federal activities to support regulatory actions.

This EPA/ORD report contains a digest and analysis of the panel reports, the planning documents and project descriptions provided by the agencies, and other pertinent information and publications to ascertain the potential contributions of the Federal noise RD&D activities to control noise that jeapordizes public health and welfare. Accordingly, Section 3 identifies the harmful effects of noise, the major stationary and mobile noise source candidates being considered by EPA, current and proposed Federal noise standards and regulations, and the goals for noise control determined by EPA as necessary to protect the public health and welfare. The report provides a summary in Section 4 of the Federal noise RD&D activities described in the panel reports. Section 5 is an analysis of the Federal noise RD&D efforts; (1) to identify major sources of noise and noise effects presently being considered in the Federal RD&D programs, (2) to identify RD&D programs which have supported the development and enforcement of existing or proposed noise standards and regulations, and (3) to identify RD&D activities which can support future standards and regulations. The analysis of the Federal RD&D programs has been carried out within the areas of noise effects, aircraft, surface vehicles, machinery, and noise measurements and measurements methodology. Because of differences in funding levels, the nature of the research, and the available information bases (principally the panel reports), the degree of detail treated in the analysis varies within each category. The summary and conclusions from the analysis are presented in Section 2.

2.0 SUMMARY & CONCLUSIONS

2.1 GENERAL

The contribution of the Federal noise RD&D programs in providing control technology to support EPA regulatory activities varies between noise source categories.

- There is a large amount of Federal noise RD&D on transportation systems, particularly aircraft, trucks, buses, and future mass transit. While the current level of RD&D effort in this area appears to be adequate, a more complete and in-depth analysis of these programs is needed.
- The current Federal RD&D activities on non-transportation noise sources, particularly stationary machinery used by industry and in construction, are inadequate. They address only a few of the hundreds of serious noise sources to which workers and the public are exposed. Furthermore, these activities are not coordinated. There is need for a concerted Federal noise control RD&D effort for those sources which are most associated with the principal noise health effect; e.g., noise-induced hearing loss.
- The recent disbanding of the joint DOT/NASA office for coordinating the Federal aircraft noise RD&D activities will place an additional burden on EPA's interagency coordination program.

Most of the known effects of noise are being addressed by current Federal research. However, several critical areas are receiving inadequate attention. These include non-auditory health effects and community response.

Similarly, while there is a great deal of emphasis on noise measurement and measurement methodologies, the current efforts are fragmented and will require effective coordination to provide adequate support for EPA regulatory and enforcement activities.

In general, the available noise control technology and techniques and the current Federal RD&D efforts would appear to be adequate to support the initial regulations being proposed and considered by EPA for major transportation and related noise sources (except motorcycles). For the major non-transportation sources being considered by EPA for regulation, there is inadequate Federal RD&D to demonstrate and establish available noise control technology. Beyond the current regulations and state-of-the art in noise control, Federally sponsored noise control RD&D currently underway is inadequate for support of future noise standards except, possibly, for aircraft.

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2.2 NOISE EFFECTS

Although hearing loss and several extra-auditory physiological and psychological effects of noise have been identified or are suspected, quantitative cause-effect relationships have been provisionally defined by the Federal Government only for hearing loss, annoyance and speech interference. Limitations in information exist for each of the major categories of noise effects which limit the development of the quantitative cause-effect relationships necessary for establishing standards and regulations protective of public health and welfare.

No in-depth analysis or assessment of the current Federal noise effects research programs has been made. The current research efforts have been categorized by the Interagency Noise Effects Research Panel into seven noise effects categories and noise effects measurement and measurement methodologies research areas. These categories are all important to the characterization of noise effects. Research categories which will require additional emphasis to defend and/or revise existing criteria and to develop improved criteria for noise effects are the areas of communication interference, individual behavior effects, non-auditory physiological effects, and noise-induced hearing loss.

2.3 AIRCRAFT NOISE RD&D

There is a considerable decrease in the Federal resource allocations for aircraft noise RD&D from $58,894,000 in FY 73 to $31,054,000 in FY 75. The principal reason for this decrease is the scheduled completion during the period of two expensive technology development and demonstration programs, the DOT/FAA Sound Absorbent Material (SAM) Nacelle program and NASA's JT8D REFAN program, which were directed toward noise control of the existing commercial jet fleet. Although the funding of noise control technology development and demonstration directly associated with noise from commercial jets decreases, Federal allocations for similar noise control technology demonstration programs for the other major aircraft noise source candidates, including advanced CTOL aircraft (See Table 3.2, page 16), increases from $3,886,000 in FY 74 to $8,020,000 in FY 76. These programs will provide the bases for aircraft noise regulations in the near future.

Federal funding of aircraft noise research and development which can define the ultimate limits to aircraft noise control and can support the development of future aircraft noise control strategies, standards and regulations designed to meet health and welfare goals for source control has remained essentially constant ($18,848,000 to $20,298,000 per FY) during the FY 74 through FY 76 time period. Generally the results of these Federal research programs will have applications to all of the major aircraft noise sources candidates.

A large percentage of the Federally sponsored aircraft noise RD&D programs consider noise as only one aspect of the total program. In many cases, considerations for noise are only a minor portion of the overall effort. In other programs the noise relevance has varied sharply from year to year. Further, each agency appears to handle the determination of noise relevance uniquely. An in-depth analysis of the technical aspects of the Federal aircraft noise RD&D programs must be carried out not only to ascertain the adequacy of these programs to satisfy health and welfare needs in a timely manner, but also to determine the actual Federal resources commitments to noise. In addition, there is a major independent research and development effort in the private sector (with support by the Federal Government) which must be considered in conjunction with the Federal programs before a complete assessment of the Federal efforts can be made and a comprehensive national aircraft noise RD&D program plan developed.

2.4 FEDERAL SURFACE VEHICLE NOISE RD&D

For the major surface vehicle sources of noise identified in Table 3.4, page 18 and for highways, for which standards and/or regulations exist, are being promulgated, or will be considered in the near term, there are supporting Federal noise control demonstration programs except for highway motorcycle noise. For the other major surface vehicle noise sources, for which regulations are expected to be promulgated in the near future, supporting Federal demonstration programs have been identified for all except automobiles, light trucks, off-road motorcycles, and motorboats.

The majority of the current Federal RD&D activities are considered to be demonstration programs designed to establish the state-of-the-art in noise control and not to develop advanced technology. Should the levels of noise control provided by available technology be inadequate to protect health and welfare, it is important to identify the Federal surface vehicle research programs which are designed to provide advanced technology. Currently the Federal government is sponsoring noise research on medium- and heavy-duty truck noise (i.e., diesel engine and truck tires), rapid rail transit system noise (i.e., wheel/rail interaction), and highway and railway noise (i.e., the effects of buildings and boundaries on the transmission of noise). There is also the possibility that certain classified DOD programs, to silence military combat vehicles, may provide advanced technology.

Generally, however, there is inadequate Federal surface vehicle noise research to provide advanced noise control technology and to identify the limits to noise control techniques. Additional research on surface vehicle noise sources will be required to support the development and implementation of future surface vehicle noise control strategies and regulations designed to achieve noise control goals necessary to protect health and welfare.

Although there are current Federal efforts addressing most of the major surface vehicle noise sources and candidates, the EPA information base on these programs is mostly superficial. In addition, it should be noted that the Federal funding reported for these programs peaked at $3,374,000 in FY 74 and appeared to decrease rapidly to $1,334,000 in FY 75 and that many of the noise RD&D activities associated with mass transportation systems are not specific to noise. Consequently, conclusions concerning the adequacy of the Federal surface vehicle programs to support the development of regulations for the surface vehicle sources being addressed will require more in-depth analysis and understanding of the current programs and an update of the present information base.

2.5 MACHINERY NOISE RD&D

The Federally sponsored machinery noise RD&D addresses machines which generate noise impacting on the outdoor environment, the home, and the workplace. EPA has developed a list of candidates for identification as major noise sources which includes 47 machines. These are listed in Table 3.5, page 19 and are sources which impact principally on the home and outdoor environment. Of the 47, EPA currently plans to identify 10 as major noise sources in the near term. These are three construction tools (chain saws, pile drivers, and pneumatic and hydraulic tools) and seven lawn care tools (edgers, hedge clippers, lawn mowers, snow blowers, leaf blowers, trimmers, and tillers).

The current Federal machinery noise RD&D addresses 2 of the 10 major environmental noise sources to be identified. They are lawn mowers and pneumatic and hydraulic tools. In the case of lawn mowers, only measurement methodology is being considered. No Federally sponsored machinery noise RD&D has been identified relating to the other eight major environmental machinery noise sources.

Of the other 37 candidates, Federally sponsored RD&D addresses only 5. They are generators, pumps, rockdrills, saws, and air conditioners. One research project was identified which intends to study noise from household appliances (consisting of 26 individual source candidates including air conditioners). No specific sources, however, were identified. There were no Federal RD&D activities identified for the following seven major construction noise source candidates: concrete mixers, concrete pumps, concrete vibrators, derrick cranes, mobile cranes, pavement breakers, and rollers.

Over 300 major machinery noise sources have been identified which impact on the industrial workplace (outside of the mining environment). Although these have not yet been considered by EPA as major noise source candidates, these sources are the ones most clearly responsible for noise-induced

hearing loss. Only 11 of these sources are specifically identified in the current Federally sponsored RD&D on machinery noise control: pneumatic and hydraulic tools, punch presses, wood planers, machine tools, heat exchangers, ducts, nozzles, diesel engines, pumps, sawblades and blowers.

An in-depth analysis of the Federal machinery noise RD&D activities has not been made. However, the available information (including that on the Navy's classified program) indicates that most of the efforts are directed toward the development and demonstration of available noise control technology and the measurement of noise emitted by machinery sources. The results from a few of these programs can be used to support the development of near-term regulations. Only a minor portion of the Federal effort ($\sim$ 15 percent of the total resourses) is research which can define the limits to noise control technology and support future regulations. Generally, the current Federal machinery noise RD&D activities have been undertaken by agencies to support their individual needs. Consequently, the current effort is fragmented and does not adequately address the major noise source candidates identified by EPA nor the machinery noise sources impacting the work environment.

3.0 BACKGROUND

3.1 EFFECTS OF NOISE

There are currently two Federal documents relating to criteria on the health effects from noise exposure. One is entitled "Criteria for a Recommended Standard . . . Occupational Exposure to Noise" and was published in 1972 by the National Institute of Occupational Safety and Health (Niosh), Department of Health, Education, and Welfare. The U.S. Environmental Protection Agency published the other report in 1973. The title is, "Public Health and Welfare Criteria for Noise."

The NIOSH document is specific to the occupational environment and provides information to support the recommended occupational standard in the area of noise-induced hearing loss, i.e., the effective noise level permitted during a normal 8-hour work period should not exceed 90 dBA for the time being and should be reduced to 85 dBA when technologically feasible. Protection of the worker from non-auditory effects of noise exposure is not addressed. The EPA criteria document addresses the effects of noise exposure on physical and mental well-being of human populations. It includes noise-induced hearing loss, other possible health effects, and the indirect effects such as annoyance and communication interference. Additionally, the EPA document addresses noise effects on wildlife and domestic animals. Table 3.1 is a listing of the categories of noise effects.

Table 3.1

CATEGORIES OF NOISE EFFECTS

I. Noise-Induced Hearing Loss
II. Non-Auditory Health Effects
III. Individual Behavior Effects
IV. Noise Effects on Sleep
V. Communication Interference
VI. Community or Collective Response
VII. Effects on Domestic Animals and Wildlife

3.1.1 Noise-Induced Hearing Loss

It has been well established that noise exposure of sufficient intensity and duration can produce hearing damage. Hearing loss resulting from intense noise exposure can either be temporary or permanent. In general, it is believed that brief exposure to noise that

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can produce a significant temporary hearing loss or threshold shift is capable of producing permanent hearing loss if the noise exposure is extended in duration or recurrence. That is, daily exposure to a noise which produces a temporary hearing loss presents a risk of permanent hearing loss because the ear may not be able to fully recover to its original threshold from recurrent exposures. The exact relationship between temporary and permanent hearing loss, however, is not yet clearly defined.

Hearing loss which is caused by noise occurs first in the high-frequency ranges. This impacts seriously on speech understanding. Good hearing in the higher frequencies is necessary for discriminating the information carrying, consonant sounds of human speech. Hearing loss is known to result from exposures to continuous noise in industrial settings, to impulsive sound, from gunfire and loud music for extended periods, especially among young people. The effect from fluctuating, intermittent or shorter-term exposures is incompletely understood.

3.1.2 Non-Auditory Health Effects

The only well-established effect upon health from noise exposure is noise-induced hearing loss. However, there is evidence, although incomplete, to indicate other effects can result from exposure of sufficient intensity and duration. Noise can alter the function of the endocrine, cardiovascular and neurologic systems. It may affect equilibrium and produce changes such as: construction of blood vessels in the body and vessel dilation in the brain, rise in blood pressure and changes in heart rhythm, and change in stomach rate of acid secretions. Noise also has been shown to produce the same physiological reactions as other stressors, such as emotional stress and pain. There is not clear evidence, however, to indicate that continued activation of any of these responses leads to irreversible changes and permanent health effects.

3.1.3 Individual Behavior Effects

When a task requires the use of auditory signals, noise that masks these signals can interfere with the performance of the task. High-level, continuous noise exposures appear to have potentially detrimental effects on human performance, particularly in the performance of vigilance tasks, information gathering and analytical processes. Noise may also increase the variability of work rate and affect the accuracy of work requiring mental concentration. Additionally, noise may be disruptive of performance if the noise is high frequency, intermittent, or unexpected. Noise throughout the audible range can, under various circumstances, be annoying and disruptive of activity. However, prediction of individual annoyance due to noise is difficult, probably due to the many psychological and social factors that contribute to individual sensitivity.

3.1.4 Noise Effects on Sleep

Noise can interfere with sleep by preventing sleep, by awakening, and by changing the level or pattern of sleep. Any of these kinds of interference may have effects on behavior and performance during waking hours as well as long-term health effects if repetitive. Survey data indicate that sleep disturbance is often the principal reason given for annoyance, and some experts believe that sleep disturbance is one of the most severe effects of noise on health.

3.1.5 Community Interference

In addition to the reduced understanding of speech resulting from noise-induced hearing loss, noise can interfere directly with speech communication. Verbal communication in terms of noise level and vocal effort is extremely difficult in backgrounds of high-level noise and can adversely affect the accuracy, frequency and quality of verbal exchange. This can be important in formal education in schools, occupational efficiency, family life patterns, and quality of relaxation.

3.1.6 Community or Collective Response

The preceding effects of noise all deal with various effects on individuals, although statistical descriptors must be used to average out individual differences in reaction or response. However, when a community of individuals is exposed, a different kind of reaction may take place. This reaction may take several forms such as complaints to authorities, political action against noisy activities, reduction in land values or socio-economic level, high property turnover rates, or changes in family recreational patterns. Thus the consequences of community response to noise can be social, political, and economic, as well as the collective individual responses noted above. To date, only community annoyance responses to aircraft noise have been studied extensively, and have been shown to correlate well with noise exposure. The number of complaints due to noise in a community, however, is small in comparison to the number of people annoyed.

3.1.7 Effects on Domestic Animals and Wildlife

In general, noise has the same types of effects on animals as it does on humans. Hearing loss and physiologic changes have been noted in laboratory animals. Possible effects on farm animals include changes in size, weight, reproductivity, and behavior. Changes in mating behavior, predator-prey relationships, and territorial behavior have been observed in some wildlife species exposed to noise.

3.2 MAJOR NOISE SOURCES

Section 5(b)(1) of the Noise Control Act of 1972 requires that EPA identify products which are major sources of noise. The regulatory process of identifying major noise sources is in progress. The noise sources discussed in the following sections are all major noise candidates and have been grouped into the source categories of aircraft, surface vehicles, and stationary machinery. At this time, only portable air compressors and new medium- and heavy-duty trucks have been officially identified by EPA as major noise sources.

3.2.1 Aircraft

Under the Noise Control Act of 1972, the Federal Aviation Administration maintains responsibility for promulgation of regulations to control aircraft noise. EPA responsibilities under Section 5(b)(1) to identify major noise sources do, however, include noise sources in air transportation. Accordingly, Table 3.2 lists aircraft categories which will be identified by EPA as major noise sources.

Table 3.2

MAJOR NOISE SOURCE CANDIDATES IN AIR TRANSPORTATION

Business jet aircraft
Commercial sub-sonic jet aircraft
Commercial supersonic jet aircraft
Helicopters
Propeller-driven small airplanes
Short-haul aircraft

In developing a list of major noise source candidates, EPA employed exposure criteria as specified in the "Levels Document." Those candidates whose cumulative noise level in normal use contributes to environmental noise levels in excess of the "Levels Document" criteria are considered major noise source candidates. Table 3.3 illustrates the noise impact from aircraft operations of the source categories listed in Table 3.2.

Table 3.3

ESTIMATED EXPOSURE TO VARIOUS YEARLY AVERAGE DAY-NIGHT SOUND LEVELS RESULTING FROM AIRCRAFT OPERATIONS (*)

Day-Night Sound in dB, Re: 20 micropascals	80	75	70	65	60	55
Cumulative Numbers of People in Millions	0.2	1.5	3.4	7.5	16	24.5

* Source of data: "Comparison of Alternative Strategies is for Identification and Regulation of Major Sources of Noise," printed as Appendix I of EPA/ONAC Action Memo (Draft, February 14, 1975).

3.2.2 Surface Vehicles

The surface vehicles which EPA presently considers to be major sources of noise and the approximate average noise levels measured at 15.24 meters (50 ft.) are listed in Table 3.4. Those sources which have been identified or are expected to be proposed in the near term are medium- and heavy-duty trucks, highway motorcycles, buses, wheel and track loaders, and wheel and track dozers.

3.2.3 Machinery

EPA has identified portable air compressors as the only major machinery noise source.[1] However, there are several candidates for identification whose cumulative noise levels in normal use contribute to environmental noise levels in excess of "Levels Document" criteria. These sources and their approximate average noise levels are shown in Table 3.5. Using a fractional impact analysis, candidates which are major contributors to environmental noise have also been determined. They are indicated by an asterisk in Table 3.5. EPA intends to identify these as major sources of noise in the near future. It should be noted that these designations are based on environmental noise impact rather than occupational noise impact, which is principally concerned with hearing loss.

Sources of machinery noise in the occupational environment are virtually countless. In general, exposures in the industrial occupational

[1] 39 FR2297, 6-21-74.

Table 3.4

MAJOR SURFACE VEHICLE SOURCES OF NOISE

Category/Source	Average Noise Level[1] (dBA Measured at 15.24m(50 ft.)
Highway Vehicles:	
Medium- and Heavy-Duty Trucks[2]	84
Truck Tires[3]	95
Motorcycles	82
Automobiles[4]	73
Light Trucks	72
Buses	82
Special Truck Auxiliary Equipment[5]	--
Rail Vehicles:	
Locomotives	94
Rapid Transit	87
Construction:	
Dozers (Wheel & Track)	87
Loaders (Wheel & Track)	79
Graders	88
Recreation:	
Snowmobiles	85
Motorboats	80
Motorcycles (including minicycles)	85

[1] Values obtained from unpublished EPA report "Rational for Identification of Major Noise Sources," September 14, 1973.

[2] Below 56.31 kilometers/hr. (35 mph).

[3] Above 56.31 kilometers/hr. (35 mph).

[4] Includes sports cars, compacts, and standard passenger cars.

[5] See Addendum, Page 135.

Table 3.5

MAJOR MACHINERY SOURCES OF ENVIRONMENTAL NOISE

Category/Source	Average Sound Level[1] (dBA measured at 15.24m (50 ft))
Construction:	
Chain saws*	83
Concrete mixers	85
Concrete pumps	82
Concrete vibrators	76
Cranes, derrick	88
Cranes, mobile	83
Generators	78
Pavement breakers	88
Pile drivers*	101
Pneumatic and hydraulic tools*	85
Pumps	76
Rock drills	98
Rollers	74
Saws	78
Lawn Care:*	
Edgers	78
Hedge clippers[2]	--
Lawn mowers	72
Snow blowers	85
Leaf blowers	76
Trimmers[2]	--
Tillers	69

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* Identified as major contributors to environmental noise. EPA intends to identify these as major noise sources in the near future.

[1] Values obtained from unpublished EPA report, "Rationale for identification of Major Noise Sources," September 14, 1973.

[2] Noise levels unavailable.

Table 3.5

MAJOR MACHINERY SOURCES OF ENVIRONMENTAL NOISE
(Concluded)

	Average Sound Level[1] (dBA measured at .914m (3ft))
Household Applicances:	
Air conditioners	58
Clothes dryers	58
Clothes washers	63
Dehumidifiers	57
Dishwashers	65
Electric can openers	66
Electric heaters [2]	--
Electric knives	72
Electric knife sharpeners[2]	--
Electric shavers	60
Electric toothbrushs[2]	--
Exhaust fans[2]	--
Floor fans[2]	--
Food blenders	75
Food disposals (grinders)[2]	--
Food mixers	66
Freezers	42
Hair clippers[2]	--
Hair dryers[2]	--
Home shop tools	83
Humidifiers	53
Refrigerators	43
Sewing machines	73
Slide/Movie Projectors[2]	--
Vacuum cleaners	73
Window fans[2]	--

[1] Values obtained from unpublished EPA report, "Rationale for Identification of Major Noise Sources," September 14, 1973.

[2] Noise levels unavailable.

environment are the most severe in terms of both level and duration. Estimates of the costs for reducing occupational noise to levels of marginal protection against hearing loss run into billions of dollars.[2] However, these estimates are crude at best and little data exist to adequately define the extent of the machinery noise problem in the occupational environment and to assess the availability and cost of technology for industrial noise control. The available data do indicate that the problem is complex in terms of the vast number of different machines in use, severe in terms of numbers of people exposed to hazardous levels of noise, and costly in terms of available control technology. Examples of sources found in some of the worst cases of noise in industry and the approximate levels are shown in Table 3.6. A more detailed listing of these sources can be found in the panel report on Federal machinery noise RD&D, FY 73 - FY 75.

3.3 FEDERAL NOISE STANDARDS AND REGULATIONS

3.3.1 Federal Aircraft Noise Standards, Regulations, and Advisor.Circulars

The Federal Aviation Administration has the responsibility for promulgating aircraft noise regulations. To date, the FAA has issued five regulations dealing with aircraft noise and sonic boom, seven Advanced Notices or Notices of Proposed Rule Making dealing with aircraft noise and five FAA Orders and Advisory Circulars (which inform the aviation public of nonregulatory material of interest and are not binding as regulations) dealing with aircraft noise. These regulations are summarized in Table 3.7 by title and source category regulated.

A comparison of the major noise source candidates in air transportation which were identified by EPA, with the sources addressed by FAA regulatory actions, shows that the FAA has issued one or more regulations, Notice(s) or Advanced Notice(s) of Proposal Rule Making which are applicable to each major source candidates except helicopters.

3.3.2 Surface Vehicles

The five Federal standards and regulations which exist or are being proposed by DOT and EPA for surface vehicle noise control are listed in

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[2] Bolt, Beranek, and Newman, Inc., "Impact of Noise Control at the Workplace," Report #2671, submitted to U.S. Department of Labor, Office of Standards, January 1974.

Table 3.6

EXAMPLES OF INDUSTRIAL MACHINERY NOISE SOURCES

Industry	Type Source	Typical Noise Levels (dBA)* (Operator Position)
Metal Working	Drop Hammers	111
	Punch Presses	110
	Riveting Machines	114
	Chipping Machines	127
Wood Working	Planers	110
	Saws	106
	Molders	105
	Tenoners	100
Textile Manufacturing	Looms	102
	Draw/Twisters	95
	Drafters	92
	Spinning	93

* Values obtained from Karplus, H., and Bonvallet, G.L., "A Noise Survey of Manufacturing Industries," American Industrial Hygiene Quarterly, Vol. 14, No. 4, Dec. 1953.

Note: Levels are only representative.

Table 3.7

FEDERAL STANDARDS, REGULATIONS AND ADVISORY CIRCULARS RELATING TO AIRCRAFT NOISE
(Agency DOT/FAA)

Title	Sources
Noise Standards: Aircraft Type Certification, FAR Part 36, 12-1-69.	Subsonic turbojet transport aircraft designed and built after 12-1-69
Noise Type Certification and Acoustic Change Approvals, NPRM 71-26, 9-13-71, Amendment to FAR Part 36, promulgated on 12-12-74.	Subsonic turbojet transport aircraft
Noise Standards for Newly Produced Airplanes of Older Type Designs, NPM 72-19, 7-7-72, Amendments to FAR Parts 36 and 21 on 10-26-73.	Subsonic turbojet transport aircraft weighing more than 75,000 lbs.
Civil Supersonic Aircraft Noise Type Certification Standards, ANPRM 70-33, 8-4-70.	Supersonic civil aircraft
Civil Airplane Noise Reduction Retrofit Requirements, ANPRM 70-44, 10-30-70.	Subsonic turbojet transport aircraft of older design not previously included in FAR Part 36
Civil Airplane Fleet Noise Level (FNL) Requirements, ANPRM 73-3, 1-24-73.	All civil transport aircraft
Civil Aircraft Fleet Noise Requirements, NPRM 74-14, 3-27-74.	All subsonic turbojet transport aircraft weighing more than 75,000 lbs.
Propeller-Driven Small Airplanes: Noise Standards for Type Certification, NPRM 73-26, 10-10-73. Amendment to FAR Part 21 & 36 issued on 1-6-75.	Propeller driven aircraft weighing less than 12,500 lbs.

Table 3.7

FEDERAL STANDARDS, REGULATIONS AND ADVISORY CIRCULARS RELATING TO AIRCRAFT NOISE
(Concluded)

Title	Sources
Noise Standards for Propeller-Driven Small Airplanes - Applicable to New Type Designs, Newly Produced Airplanes of Older Type Designs, NPRM 74-39, 1-6-75.	Propeller-driven aircraft weighing less than 12,500 lbs.
Noise Standards: Short Haul Aircraft, ANPRM 73-32, 12-14-73.	Short, reduced and vertical take off and landing aircraft
Recommended Noise Abatement Take Off Procedures for Civil Turbojet Powered Airplanes, AC-91-39, 1-18-74.	Commercial aircraft
Two Segment ILS Noise Abatement Approach, ANPRM 74-12, 3-26-74.	Commercial aircraft
Arrival and Departure Handling of High Performance Aircraft, AC 90-59 and FAA Order 7110.22A, 2-28-72. (AEO Minimum Attitudes: NPRM 74-40).	Turbojet transport aircraft
VFR Flight Near Noise-Sensitive Areas, AC 91-36, 7-8-72.	Turbojet transport aircraft
General Operating and Flight Rules Covering Civil Aircraft Sonic Boom, NPRM 70-16, 4-10-70; Amendment to FAR Part 91, issued on 4-27-73.	Civil aircraft

Table 3.8. DOT has issued two regulations: one limits interior noise levels (at the driver's seating position) of new and in-service trucks and buses to 90 dBA and the other specifies design noise levels for highways as a function of different land uses. DOT is also required to promulgate enforcement regulations for all EPA surface vehicle noise emission standards and regulations.

The EPA has issued a regulation for motor carriers (trucks) used in interstate commerce. The noise emission standards require that the truck noise levels measured at 15.24 meters (50 ft.) not exceed 86 dBA at 56.31km/hr. (35 mph) and 88 dBA in the stationary run-up test. EPA has also proposed regulations for rail carriers (locomotives and rail cars) used in interstate commerce and newly manufactured medium- and heavy-duty trucks. The proposed railway regulations limit stationary locomotive noise levels measured at 30 meters (100 ft.) to 93 dBA at any throttle setting and 73 dBA at idle. The standard for all locomotives or combination of locomotives when moving is 96 dBA when measured at 30 meters (100 ft.). Four years after promulgation, the corresponding standards will be lowered to 87, 67, and 90 dBA respectively. For railroad cars, the standard noise levels when measured at 30 meters (100 ft.) are 88 dBA for speed up to and including 72 km/hr (45 mph) and 93 dBA at speeds above 72 km/hr (45 mph). For new medium- and heavy-duty trucks the proposed regulation will limit the noise levels when measured at low speeds (EPA test procedures similar to SAE J3666) to 83 dBA for 1977-80 models, 80 dBA for 1981-82 models and 75 dBA for 1983 and subsequent models. The high speed standard (EPA test procedure similar to SAE J57) will be 86 dBA for 1977 and subsequent models.

3.3.3 Machinery

There are two Federal regulations being proposed for machinery sources of noise and one already in existence. EPA has proposed Noise Emission Standards for Construction Equipment - New Portable Air Compressors NPRM, 39FR 38186, 10-29-74. The proposed standard limits the average sound level of new portable air compressors with a rated output of 75cfm or more to 76 dBA when measured at a distance of 7 meters (23 ft.) from the surfaces of the compressor.

The Consumer Product Safety Commission has proposed that a regulation for lawnmower noise be set in a notice of proceeding, 39FR 26662, 7/17/74. However, the only RD&D identified relating to this proposal has been the development of a measurement methodology. For the purpose of this report, lawnmowers will be treated as a candidate for identification as a major source of environmental noise.

The Consumer Product Safety Commission also has a standard for toy guns and caps, 16CFR Chapter II, Subchapter C, part 1500, 9/27/73. This bans the sale of toy guns and caps in violation of noise emission standards. No RD&D in fiscal years 1973 - 1975 has been associated with this regulation.

Table 3.8

FEDERAL STANDARDS AND REGULATIONS RELATING TO SURFACE VEHICLES

Agency	Title	Sources
DOT/FHWA/BMCS	Vehicle Interior Noise Levels, Title 49, Part 393.94, 11-8-73.	Trucks & Buses - New and in-service
DOT/FHWA	Noise Control Standards and Procedures,[1] Title 23, Part 772, 6-19-73, amended 2-2-74.	Highways (noise levels as a function of land uses)
EPA/ONAC	Noise Emission Standards (for) Motor Carriers Engaged in Interstate Commerce, Title 40, Part 202, 10-29-74.	Trucks
EPA/ONAC	Proposed Emission Standards For Interstate Rail Carrier Noise, NPRM, 39 FR 24580, 7-3-74.	Locomotives, rail cars
EPA/ONAC	Transportation Equipment Noise Emission Controls: Proposed Standards for Medium and Heavy-Duty Trucks, NPRM, 39 FR 38338, 10-15-74.	New trucks

[1] Formerly this was the DOT/FHWA Policy and Procedures Memorandum -- PPM 90-2.

3.4 NATIONAL HEALTH AND WELFARE GOALS FOR NOISE CONTROL

In 1974, the U. S. Environmental Protection Agency published a document entitled, "Information of Levels of Environmental Noise Requisite to Protect the Public Health and Welfare with an Adequate Margin of Safety." The document serves to identify environmental noise levels in various areas and conditions necessary to ensure no adverse health or welfare effects. At the present time, this is the only document published by a Federal agency which identifies such goals. The document provides a basis for an overall assessment of the national impact of noise and the relative contribution from various product types to this impact. Such an assessment has not been done at this time. Therefore, goals for control of the major noise sources have not yet been established.

Table 3.9 is a summary of the identified levels; Table 3.10 illustrates this information in more detail.

Tables 3.9 and 3.10 identify levels for both activity interference and hearing loss. It is seen that these levels or goals can be related to the source categories of noise. The purposes of identifying these noise levels are to provide a basis for establishing noise level goals for control of specific noise sources and for the assessment of noise source emission regulations, human exposure standards, land use planning, and zoning and building codes as to their effectiveness in the protection of public health and welfare from environmental noise.

The levels of noise which have been identified are not to be considered as standards, nor as discrete numbers since they are in terms of energy equivalents. The EPA believes that environmental noise levels, when maintained at or below those identified, will protect the public from adverse health and welfare effects. That is, a person may move through several different noise environments throughout the day without suffering hearing impairment as long as the daily equivalent sound energy does not exceed 70 dB. Similarly, activity interference will not be undue if outdoor levels are maintained at an energy equivalent of 55 dB and indoor levels at 45 dB.

Table 3.9

SUMMARY OF NOISE LEVELS IDENTIFIED AS REQUISITE TO PROTECT PUBLIC HEALTH AND WELFARE WITH AN ADEQUATE MARGIN OF SAFETY

Effect	Level	Area
Hearing Loss	$L_{eq(24)} \leq 70dB$	All Areas
Outdoor activity interference and annoyance	$L_{dn} \leq 55dB$	Outdoors in residential areas and farms and other outdoor areas where people spend widely varying amounts of time and other places in which quiet is a basis for use.
	$L_{eq(24)} \leq 55dB$	Outdoor areas where people spend limited amounts of time, such as school yards, playgrounds, etc.
Indoor activity interference and annoyance	$L_{dn} \leq 45dB$	Indoor residential areas.
	$L_{eq(24)} \leq 45dB$	Other indoor areas with human activities such as schools, etc.

Explanation of Table 3.9:

$L_{eq\ (24)}$ represents the sound energy averaged over a 24-hour period while L_{dn} represents the L_{eq} with a 10dB nighttime weighting.

- The hearing loss level identified here represents annual averages of the daily level over a period of 40 years. (These are energy averages, not to be confused with arithmetic averages.)

- Relationship of an $L_{eq(24)}$ of 70dB to higher exposure levels.

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Table 3.10

YEARLY AVERAGE* EQUIVALENT SOUND LEVELS IDENTIFIED AS REQUISITE TO PROTECT THE PUBLIC HEALTH AND WELFARE WITH AN ADEQUATE MARGIN OF SAFETY

	Measure	Indoor Activity Interference	Indoor Hearing Loss Consideration	Indoor To Protect Against Both Effects (b)	Outdoor Activity Interference	Outdoor Hearing Loss Consideration	Outdoor To Protect Against Both Effects (b)
Residential with Outside Space and Farm Residences	L_{dn}	45		45	55		55
	$L_{eq(24)}$		70			70	
Residential with No Outside Space	L_{dn}	45		45			
	$L_{eq(24)}$		70				
Commercial	$L_{eq(24)}$	(a)	70	70(c)	(a)	70	70(c)
Inside Transportation	$L_{eq(24)}$	(a)	70	(a)			
Industrial	$L_{eq(24)}$(d)	(a)	70	70(c)	(a)	70	70(c)
Hospitals	L_{dn}	45		45	55		55
	$L_{eq(24)}$		70			70	
Institutional	$L_{eq(24)}$	45		45	55		55
	$L_{eq(24)}$(d)		70			70	
Recreational Areas	$L_{eq(24)}$	(a)	70	70(c)	(a)	70	70(c)
Farm Land and Coastal Unpopulated Land	$L_{eq(24)}$				(a)	70	70(c)

Code;

a. Since different types of activities appear to be associated with different levels, identification of a maximum level for activity interference may be difficult except in those circumstances where speech communication is a critical activity.
b. Based on lowest level.
c. Based only on hearing loss.
d. An $L_{eq(8)}$ of 75 dB may be identified in these situations so long as the exposure over the remaining 16 hours per day is low enough to result in a negligible contribution to the 24-hour average; i.e., no greater than an L_{eq} of 60 dB.

NOTE: Explanation of identified level for hearing loss. The exposure period which results in hearing loss at the identified level is a period of 40 years.

*Refers to energy rather than arithmetic averages.

4.0 FEDERAL NOISE RD&D ACTIVITIES

4.1 OVERVIEW

Eleven Federal agencies or departments sponsor noise RD&D. These are NASA, DOT, HEW, DOD, NSF, DOI, DOC/NBS, USDA, CPSC, HUD, and EPA. Their noise RD&D activities can be classified into four areas which correspond to the four interagency panels: (1) noise effects, (2) aircraft noise, (3) surface vehicle noise, and (4) stationary machinery noise. Table 4.1 summarizes the RD&D currently being addressed by each Federal agency. Most of the agencies sponsor research in more than one category. However, only DOD and EPA have activities in all four noise RD&D areas. Noise effects research is being sponsored by nine Federal agencies and is the category having the greatest number of Federal participants. Stationary machinery noise RD&D is next, being considered by eight Federal agencies. Aircraft noise RD&D is currently being sponsored by NASA, DOT, DOD, and EPA while DOT, DOD, EPA, NSF, and USDA all support surface vehicle noise RD&D.

The total resources allocated to noise RD&D by the Federal agencies are summarized in Table 4.2 for FY 73, FY 74, and FY 75. NASA, DOT, and DOD allocated the major portion of the Federal resources for noise RD&D but their allocations have steadily decreased since FY 73. As a result total Federal resources for noise RD&D have also steadily decreased since FY 73, with the major decrease taking place from FY 74 to FY 75. The latter is primarily due to the decrease in the NASA noise RD&D allocations. HEW, DOI, DOC/NBS, and USDA show steady increases in resource allocations for noise RD&D during the FY 73 through FY 75 time period.

Of the noise research categories shown in Table 4.3 only Federal expenditures for noise effects research increased steadily during the FY 73 to FY 75 time period. Federal allocations for RD&D to control aircraft noise decreased rapidly from $58,894.00 in FY 73 to $31,054,000 in FY 75 and related directly to the decrease in aircraft noise control RD&D sponsored by NASA, DOT, and DOD. The major element in this reduction is the scheduled completion during this period of two expensive technology development and demonstration programs for retrofit to existing aircraft -- FAA's Sound Absorbent Material (SAM) Nacelle program and NASA's JT8D REFAN program. However, Federal allocations for aircraft noise control RD&D still account for 80 to 90 percent of the total Federal noise RD&D allocations during the FY 73 - 75 time period. Federal resources for both surface vehicle and stationary machinery noise RD&D peak in FY 74. Although a number of Federal agencies sponsor work in these categories, they receive the least emphasis based on resource allocations.

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Table 4.1

SUMMARY OF FEDERAL AGENCIES' CURRENT INVOLVEMENT IN NOISE RESEARCH

Agency	Area of Involvement			
	Noise Effects	Aircraft	Surface Vehicles	Stationary Machinery
NASA	X	X		
DOT	X	X	X	
HEW	X			X
DOD	X	X	X	X
NSF	X		X	X
DOI	X			X
DOC/NBS	X			X
USDA			X	X
CPSC				X
HUD	X			
EPA	X	X	X	X

Table 4.2

SUMMARY OF FEDERAL AGENCY EXPENDITURES FOR NOISE RESEARCH

Agency	Fiscal Year Funding (Thousands of Dollars) 1973	1974	1975
NASA	46,407	47,232	28,504
DOT	13,767	5,269	3,467
HEW	1,090	1,613	2,015
DOD	3,897	4,621	3,063
NSF	263	658	--
DOI	409	551	730
DOC/NBS	236	381	407
USDA	4	93	131
CPSC	--	70	--
HUD	117	638	460
EPA	453	1,189	409
Totals	66,643	62,315	39,186

Table 4.3

SUMMARY OF FEDERAL EXPENDITURES FOR NOISE RESEARCH CATEGORIES

Category	Fiscal Year Funding (Thousands of Dollars) 1973	1974	1975
Noise Effects	3,566	5,006	5,228
Aircraft	58,894	51,751	31,054
Surface Vehicle	3,211	3,374	1,334
Machinery	972	2,184	1,570
Totals	66,643	62,315	39,186

The Federal programs are briefly described in the following sections. The information will be presented by the noise research categories of noise effects, aircraft noise, surface vehicle noise and stationary machinery noise. In addition, the Federally sponsored noise measurements RD&D will be separately reviewed in Section 5.5. More complete information on the Federal RD&D can be obtained by referring to the panel reports mentioned in Section 1.3.

4.2 NOISE EFFECTS RESEARCH

There are nine Federal agencies conducting research on noise effects. Table 4.4 is a summary of the funding by agency for the fiscal years 1973-1975. The total funding over this period has increased by 68 percent. This is principally due to the large increase of expenditures by HEW/NINDS and the steadily increasing resource allocations by the DOD and NASA.

Table 4.5 identifies the research categories that are currently being addressed by each of the participating Federal agencies. This table reflects several major points regarding the various agency programs. Within HEW, three separate institutions are involved in the conduct of noise effects research; NINDS, NIEHS, and NIOSH. The NINDS has major research efforts ongoing in the areas of noise-induced hearing loss and communication interference. The NIEHS research is conducted mostly on animals. The major part (83 percent) is directed toward noise-induced hearing loss and the remainder is allocated to the support of non-auditory health effects research. NIOSH has a major research effort in noise-induced hearing loss which includes both epidemiological and experimental activities. In addition, NIOSH is supporting research on non-auditory health effects and in the area of measurement methodology and calibration.

The DOD, like the EPA, pursues a broad research effort which includes each of the following categories: noise-induced hearing loss, non-auditory health effects, individual behavior effects, communication interference, and measurement methodology and calibration. In addition, DOD sponsors research on community and collective response effects while EPA conducts research on sleep effects.

NASA has a major research effort in the area of community or collective response and, in addition to the EPA, is the only agency involved in research on the effects of noise on sleep. HUD has a major effort in community or collective response and devotes nearly 90 percent of its funds to this area. The DOT currently has the smallest active research program in noise effects, but directs all of its support toward community or collective response.

NBS directs all its noise effects research to individual behavior.

Table 4.4

NOISE EFFECTS RESEARCH FUNDING BY AGENCY

Agency	Fiscal Year Funding (Thousands of Dollars) 1973	1974	1975
HEW/NINDS	526	622	1,157
HEW/NIEHS	153	258	239
HEW/NIOSH	395	507	481
DOD	984	1,180	1,190
NASA	1,127	1,154	1,200
DOT	50	130	50
NSF	20	--	--
DOC/NBS	98	117	142
HUD	117	638	460
EPA	24	377	309
DOI/BuMines	72	23	--
Totals	3,566	5,006	5,228

Table 4.5

CURRENT AGENCY INVOLVEMENT IN NOISE EFFECTS RESEARCH CATEGORIES

Agency	Research Category: Noise-Induced Hearing Loss	Non-Auditory Health Effects	Individual Behavior Effects	Noise Effects on Sleep	Communication Interference	Community or Collective Response	Domestic Animals & Wildlife	Measurement Methodology & Calibration
HEW/NINDS	X				X			
HEW/NIEHS	X	X						
HEW/NIOSH	X	X	X					X
DOD	X	X	X		X	X		X
NASA				X		X		X
DOT			X			X		
DOC/NBS			X					
HUD						X		X
EPA	X	X	X	X	X			X
NSF	X							
DOI/BuMines					X			X

At this time, no agency has any ongoing research activity on the effects of noise on domestic animals and wildlife.

Table 4.6 is a summary of the funding as a function of research category for the fiscal years 1973-1975. There has been a steady increase in the funding for noise-induced hearing loss which in FY 75 received 38 percent of the total effects research resources. A significant increase in funding for the community or collective response category is shown for FY 75. Except for the non-auditory health effects category, which shows a decrease in effort for FY 75, the funding has remained fairly constant for remaining categories.

4.3 AIRCRAFT NOISE RD&D

Federally sponsored aircraft noise RD&D is classified by noise source categories and by categories that have broad applications. Aircraft noise sources being considered in the Federal RD&D include the following: subsonic conventional take-off and landing aircraft (CTOL), powered lift aircraft including short take-off and landing aircraft, (STOL) and reduced take-off and landing (RTOL) aircraft, rotorcraft and vertical take-off and landing aircraft (VTOL), supersonic cruise aircraft, and general aviation aircraft. Table 4.7 summarizes the Federal agency resource allocations for fiscal years 1973-1976 for all aircraft noise RD&D categories.

Funding for basic research and technology programs shows only minor fluctuations in this period. Programs in this category have broad application and apply to all aircraft noise source types. Funds for noise portions of systems studies to define air transportation needs are relatively low. There is a significant increase in funding for general aviation aircraft noise. The projected FY 76 funding for general aviation is over 10 times the amount of FY 73. Noise related programs applied to supersonic cruise aircraft are about the same in FY 73 and FY 74 and FY 75 and FY 76. Funding for noise related to powered lift and rotorcraft/VTOL levels out in FY 74 and is fairly constant through FY 76. Noise programs in the CTOL category apply mostly to the existing commercial aircraft fleet. Funding in this category shows significant decreases in FY 74, FY 75, and FY 76. A major factor in the decreases is the completion during this period of two demonstration programs leading to certifiable hardware suitable for retrofit to existing aircraft -- the FAA's Sound Absorbent Material (SAM) nacelle program and NASA's JT8D REFAN program.

Table 4.8 shows funding by agency for all RD&D categories for the fiscal years 1973-1976. NASA plays the dominant role in all categories of aircraft noise RD&D, especially as total funding levels out in FY 75 and FY 76 with the completion of the REFAN and the retrofit feasibility program of DOT/FAA. The decrease in DOT funding is

Table 4.6

NOISE EFFECTS RESEARCH FUNDING BY CATEGORY

Category	Fiscal Year Funding (Thousands of Dollars) 1973	1974	1975
Noise-Induced Hearing Loss	1,084	1,366	1,979
Non-Auditory Health Effects	126	294	61
Individual Behavior Effects	381	361	443
Noise Effects on Sleep	217	254	159
Communication Interference	275	316	296
Community or Collective Response	410	821	1,114
Domestic Animals and Wildlife	--	--	--
Measurement Methodology and Calibration	1,073	1,594	1,176
Totals	3,566	5,006	5,288

Table 4.7

SUMMARY OF FEDERAL AIRCRAFT NOISE RD&D ACTIVITIES AND RESOURCE ALLOCATIONS

Technical Area	Sponsoring Agency	Fiscal Year Funding (Thousands of Dollars) 1973	1974	1975	1976
Subsonic Conventional Aircraft	NASA	27,704[1/5]	25,204	6,017	2,703
	DOT	8,176	1,899	900	--
	Subtotal	35,880	27,103	6,917	2,703
Powered Lift Aircraft	NASA	4,406[1]	2,082	2,977	2,952
	DOT	241	--	--	--
	Subtotal	4,647	2,082	2,977	2,952
Rotorcraft/VTOL	NASA	--[2]	1,774	2,284	2,294
	DOD	267	534	675	275
	Subtotal	267	2,308	2,959	2,569
Supersonic Cruise Aircraft	NASA	2,070[1/3]	2,086	1,490	1,730
	DOT	316	299	100	--
	Subtotal	2,386	2,385	1,590	1,730
General Aviation	NASA	80[1]	355	448	996
	Subtotal	80	355	448	996
Air Transportation Systems	NASA	255[4]	428	248	227
	EPA	--	404	--	--
	Subtotal	255	832	248	227
Basic Research and Technology	NASA	10,765[1]	14,149	13,840	14,269
	DOT	2,830	785	1,282	1,760
	DOD	1,784	1,752	793	1,112
	Subtotal	15,379	16,686	15,915	17,141
GRAND TOTAL		58,894	51,751	31,054	28,318

[1] The NASA funding data included in this table for FY 73 are based on information supplied to EPA by NASA in December, 1973. The content of the breakouts by research area is not exactly the same as those for other fiscal years listed.

[2] FY 73 funding included in Powered Lift Aircraft Noise Technology.

[3] Some program activity included here that is listed under Basic Research and Technology for other fiscal years.

[4] EPA FY 74 total includes some funds committed in FY 73.

[5] For FY 73, $1090K of the funds listed were for subsonic engine and nacelle technology -- Quiet Engine I.

Table 4.8

SUMMARY OF FEDERAL AGENCIES' RESOURCE ALLOCATIONS FOR AIRCRAFT NOISE RD&D

Agency	Fiscal Year Resources (Thousands of Dollars) 1973	1974	1975	1976
NASA	45,280	46,078	27,304	25,171
DOT	11,563	2,983	2,282	1,760
DOD	2,051	2,286	1,468	1,387
EPA	--[1]	404	--	--
Total	58,894	51,751	31,054	28,318

[1] EPA FY 74 total includes some funds committed in FY 73.

consistent with the decision by FAA to recommend the SAM retrofit alternative which limits the necessity for major funding to be applied to existing commercial fleet noise reduction. Most of the DOT funds in FY 75 and FY 76 are in the category of basic research and technology and are applicable to technology needs for future aircraft noise regulations. DOD's program shows a steady decrease in resource allocations during the FY 73-76 time period. However, most of DOD's resources are committed to basic research and technology and will also be applicable to support of future aircraft noise regulations.

4.4 SURFACE VEHICLE NOISE RD&D

The Federal agencies known to sponsor surface vehicle noise RD&D activities are DOT, DOD, EPA, USDA, and NSF. Table 4.9 is a summary of the major surface vehicle noise RD&D programs being sponsored by these agencies. The total noise dedicated resources allocated by the Federal Government peaked at $3,374,000 in FY 74.

The DOT is the principal Federal agency sponsoring surface vehicle noise RD&D. These activities are primarily concerned with transportation systems and are associated with three major programs. They are the Highway Noise Reduction Program, Urban Transportation System Noise Reduction Program, and Conventional Railroad and Intercity High Speed Systems Program. With emphasis on control of highway noise, the major efforts have concentrated on the control of heavy-duty truck and bus noise. Future research efforts emphasize truck tire and engine mechanical and combustion noise.

Although the DOT resource allocations to reduce noise from urban transportation and conventional and high speed railway transportation systems are not specifically identifiable from within total development funding, significant noise RD&D efforts are underway in these non-noise dedicated programs. The emphasis is in the development of future mass transportation systems. As such, noise is only one of many factors being considered and is often addressed as a design specification.

The DOD/Army has three RD&D programs concerned with surface vehicle noise control. They are entitled, "The Conformance with Regulatory Requirements," "Vehicle Signature Reduction Program," and "The Noise Reduction Program for U.S. Army Construction Equipment." These programs are funded by the U.S. Army Tank Automotive Command (TACOM) and the U.S. Army Mobility Equipment Research and Development Center (MERDC) and address highway and off-highway military vehicles. The TACOM Conformance with Regulatory Requirements Program is directed toward reducing interior and exterior noise levels of all tactical type military vehicles to meet military and commercial noise standards. The MERDC Noise Reduction Program for U.S. Army Construction Equipment was initiated as a result of the low noise exposure level requirements established by the Army

Table 4.9

SUMMARY OF THE FEDERAL SURFACE VEHICLE NOISE RD&D PROGRAMS

Sponsoring Agency	Descriptive Title of Program	Fiscal Year Funding (Thousands of Dollars) Prior to 1973	1973	1974(est)	1975[2]
DOT	Highway Noise Reduction	2,066	1,798	1,429	935
	Urban Transportation System Noise Reduction Program[1]	--	356	577	--
	Conventional Railroad & Intercity High Speed Systems[1]	--	--	150	200
	Total DOT	2,066	2,154	2,156	1,135
DOD/ARMY	Conformance with Regulatory Requirements	--	215	270	--
	Vehicle Signature Reduction	100	100	95	--
	Noise Reduction Program for U.S. Army Construction Vehicles	--	369	300	160
	Total DOD/ARMY	100	684	665	160
EPA	Interstate Motor Carriers	--	170	--	--
	Interstate Rail Carriers	--	199	178	--
	New Medium & Heavy-Duty Trucks	--	--	--	--
	Total EPA	--	369	178	--
USDA	Reduction of Vehicle (snowmobile) & Equipment Noise Levels	--	--	25	39
	Use of Trees & Shrubs in Noise Abatement	--	--	20	--
	Noise & Vibration of Off-Road Equipment	--	4	28	--
	Total USDA	--	4	73	39
NSF	Effects of Building & Other Boundaries on Motor Vehicle Noise	--	--	30	--
	Noise & Vibration from Transportation Vehicles & Other Machinery	--	--	272	--
	Total NSF	--	--	302	--
	Total FEDERAL EFFORT	2,166	3,211	3,374	1,334

[1] Resources for in-house research and noise portions of advanced transportation systems development are not included.

[2] FY 75 estimates are known to be incomplete.

Surgeon General and is concerned with the control of noise from both stationary and vehicular construction equipment. The TACOM Vehicle Signature Reduction program is concerned with reducing the noise signature detectability of military vehicles for combat purposes. Portions of this program are classified. Although no other DOD surface vehicle research programs were identified, there is evidence that other pertinent noise reduction programs are being sponsored by DOD, particularly by the Navy on watercraft. DOD plans to continue a similar effort during the FY 75 through FY 78 period.

The EPA identified three surface transportation research programs which were sponsored in FY 73 and FY 74 to support the Interstate Motor Carrier, Interstate Rail Carrier, and New Medium- and Heavy-Duty Truck Regulations. These studies generally involved the determination of the population impacted by the noise source to be regulated, best available noise control technology, costs for compliance with the proposed regulations, and measurement methods for enforcing the regulation.

The USDA sponsors surface vehicle noise research through the Forest Service and the Cooperative State Research Service. These programs are concerned with control of off-road vehicle noise and the use of trees and shrubs to abate noise. Only the off-road vehicle noise control research activities of the Forest Service are planned to continue into the future. The Cooperative State Research Service will continue to support noise research proposed by individual scientists and engineers.

The NSF sponsors noise research based upon the merits of unsolicited proposals. Currently, there are two NSF research grants specific to surface vehicle noise. They are entitled, "The Effects of Building and Other Boundaries on Motor Vehicle Noise" and "Noise and Vibration from Transportation Vehicles and Other Machinery." A third grant entitled, "Basic and Applied Studies of Noise," has a minor portion of the study addressing sound generation by automotive tire designs.

4.5 MACHINERY NOISE RD&D

Table 4.10 shows the Federal agencies' allocations for machinery noise RD&D during the FY 73 through FY 75 time period. A total of eight Federal agencies, including two components of DOD, are sponsoring machinery noise RD&D. The Navy's program is the largest, committing about 1 million dollars per year. However, the output of this effort is classified and is not currently available to the public. The other agencies together spent in FY 74 a total of more than 2 million dollars on machinery noise RD&D. The total Federal effort has been in the range of 2 or 3 million dollars per year for the FY 73 through FY 75 time period and appeared to peak in FY 74.

Table 4.10

MACHINERY NOISE RD&D FUNDING BY AGENCY
(Thousands of Dollars)

	1973	1974	1975
DOI/BuMines	337	528	730[1]
DOC/NBS	138	264	265
HEW/NIOSH	16[2]	226	138
NSF	243	356	--
EPA	60	230	100
DOD/USN[3]	--	--	--
DOD/USA	178	490	245[1]
CPSC	--	70	--
USDA	--	20	92
Total	972	2,184	1,570

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[1] Projected.

[2] This figure does not reflect $60.5K funded in FY 72 for work done in FY 73.

[3] Navy funding for specific RD&D activities in Machinery Noise cannot be reported for security reasons. However, the total effort in this area is about $1 million each year.

The current Federal machinery noise RD&D programs address a number of specific sources of machinery noise, undertake work in building and structural transmission of noise, and work toward better definition of the machinery noise problem through development of more accurate and standardized measurement methodology. The general funding in these areas is presented in Table 4.11. The majority of funds are spent on control technology. This observation is further supported by the Navy's million dollar a year program, most of which goes for source control technology. It also appears that the funds for machinery noise RD&D peaked in FY 74. This may not be actual, however, due to the uncertainity of the FY 75 data.

The agencies' current involvement in the three categories of machinery noise RD&D is shown in Table 4.12. USDA and CPSC are involved only in measurement or measurement methodology; NSF, DOD and NIOSH are supporting research in all three areas, while BuMines, NBS, and EPA are involved in two categories.

Table 4.11

SUMMARY BY AREA OF MACHINERY NOISE RD&D

RD&D Area	Funding (Thousands of Dollars) 1973	1974	1975
Source Noise Control Technology	529	1,307	1,168
Building and Structural Noise Transmission and Control	162	370	145
Measurements and Measurement Methodologies	280	507	257
Totals	971	2,184	1,570

Table 4.12

CURRENT AGENCY INVOLVEMENT IN AREAS OF MACHINERY NOISE RD&D

Agency	Area of Involvement: Source Noise Control Technology	Building and Structural Noise Transmission and Control	Measurements and Measurement Methodologies
BuMines	X		X
NIOSH	X	X	X
NSF	X	X	X
DOD	X	X	X
NBS		X	X
EPA	X		X
CPSC			X
USDA			X

5.0 FEDERAL NOISE RD&D SUPPORTING STANDARDS AND REGULATIONS DEVELOPMENT AND ENFORCEMENT

5.1 NOISE EFFECTS CRITERIA

A summary of the Federal noise effects research funding according to area of activity is shown in Table 5.1. Except for the allocation of funds for the support of measurement methodology and calibration, the current expenditures support the development of criteria for the noise effects defined in Table 3.1 (p. 13).

Table 5.1

NOISE EFFECTS RESEARCH FUNDING BY CATEGORY
(Thousands of Dollars)

Category	FY 73	FY 74	FY 75
Noise-Induced Hearing Loss	1,084	1,366	1,979
Non-Auditory Health Effects	126	294	61
Individual Behavior Effects	381	361	443
Noise Effects on Sleep	217	254	159
Communication Interference	275	316	296
Community or Collective Response	410	821	1,114
Domestic Animals and Wildlife	0	0	0
Measurement Methodology and Calibration	1,073	1,594	1,176
Totals	3,566	5,006	5,228

Noise-Induced Hearing Loss - Research on noise-induced hearing loss continues to be of high importance relative to the development of criteria because it is the one established adverse health effect from noise exposure. To strengthen and/or support existing criteria, nearly 40 percent of the total Federal expenditures for effects research is being spent on noise-induced hearing loss during FY 75 by five agencies. Table 5.2 summarizes these expenditures.

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Table 5.2

FEDERAL RESEARCH FUNDING FOR NOISE-INDUCED HEARING LOSS
(Thousands of Dollars)

Agency	FY 73	FY 74	FY 75
HEW (NINDS)	447	482	1,057
HEW (NIEHS)	224	341	352
HEW (NIOSH)	145	192	199
DOD	248	301	301*
NSF	20	0	0
EPA	0	50	70
Totals	1,084	1,366	1,979

* DOD FY 75 data estimated the same as FY 74.

Current research in this area addresses the following:

- Cross-sectional studies in various environments (occupational, military, recreational, etc.).
- Relationships between permanent and temporary threshold shifts.
- Susceptibility to hearing loss.
- Combination of noise and other stressors (work, heat, vibration, etc.).
- Combination with ototoxic drugs, other ototoxic agents, and abnormal physiology.
- Effects on children.
- Impulse noise, intermittent noise, and high-intensity noise.
- Permanent effects of occupational and longer environmental exposures.
- Mechanisms of hearing loss (biochemical, physiological, etc.).
- Hearing protection.

Non-Auditory Health Effects - Results of existing studies indicate noise contributes to numerous non-auditory health effects which adversely influence physical or mental health. Despite many questions which remain unanswered at the present time regarding the non-auditory health effects from noise exposure, Federal expenditures in support of this area of criteria are currently little more than 1 percent of the total effects funding. Current research in this area is being conducted by three different agencies which are addressing the following:

- Worker safety and health.
- Susceptibility to mental and physical illness.
- Cardiovascular and other physiologic changes.
- Effects on the vestibular (sense of balance), cardiovascular (heart and circulatory), endocrine (internally-secreting glands), and neutral systems.
- Effects on drug uptake.
- Non-auditory physiological system adaptation.

Table 5.3 is a summary of current funding for this area.

Table 5.3

FEDERAL RESEARCH FUNDING FOR NON-AUDITORY HEALTH EFFECTS OF NOISE
(Thousands of Dollars)

Agency	FY 73	FY 74	FY 75
HEW (NINDS)	8	66	40
HEW (NIOSH)	108	42	21[1]
DOD	10	0	0
EPA	0	186[2]	0
Totals	126	294	61

[1] DOD FY 75 data estimated the same as FY 74.

[2] 2-year project.

Individual Behavior Effects - Individual behavior effects are of interest in a variety of environments where adverse reflex actions or behavior may result in accidents or unfavorable performance. Effects of noise on performance, which is considered a highly significant area of study, have been studied in the laboratory and work environment. However, well-controlled field studies present a real problem in the evaluation of the effects of noise on human performance. Of the current fiscal year support, only 9 percent of these funds are directed toward individual behavior effects. Table 5.4 is a summary of the expenditures by agency in this area. Current research in this area is conducted by five agencies addressing the following:

- Annoyance factors.
- Performance capability.
- Startle effects on performance.
- Adaptation to noise.
- Measures of aversiveness and annoyance.

Table 5.4

FEDERAL RESEARCH FUNDING FOR INDIVIDUAL BEHAVIOR EFFECTS OF NOISE
(Thousands of Dollars)

Agency	FY 73	FY 74	FY 75
HEW (NIOSH)	0	28	0
DOD	233	166	166*
DOT	50	0	0
EPA	0	50	135
DOC (NBS)	98	117	142
Totals	381	361	443

* DOD FY 75 data estimated the same as FY 74.

Noise Effects on Sleep - Sleep disturbance is often considered the principal reason given for noise annoyance. Most of the existing data in this area are based on laboratory experiments that involve few subjects and responses are evaluated in terms of physiological measurements. Only about 3 percent of FY 75 funding is being devoted to this critical area by two agencies as shown in Table 5.5.

Table 5.5

FEDERAL RESEARCH FUNDING FOR NOISE EFFECTS ON SLEEP
(Thousands of Dollars)

Agency	FY 73	FY 74	FY 75
NASA	217	254	142
EPA	0	0	17
Totals	217	254	159

Communication Interference - Noise can interfere with speech by changing its perceived quality, shifting its apparent location or loudness, or by making it partially or completely inaudible. Speech is considered a major activity of importance in identifying levels of noise necessary to protect public health and welfare. The available knowledge in this area is still rather limited. The current Federal research in communication interference by noise is conducted by four agencies (Table 5.6). The expenditures make up 6 percent of the effects funding.

Table 5.6

FEDERAL RESEARCH FUNDING FOR COMMUNICATIONS INTERFERENCE OF NOISE
(Thousands of Dollars)

Agency	FY 73	FY 74	FY 75
HEW (NINDS)	79	140	100
DOD	124	109	109*
EPA	0	59	87
DOI (BuMines)	72	8	0
Totals	275	316	296

* DOD FY 75 data estimated the same as FY 74.

Community or Collective Response - The second largest portion (22 percent) of the current Federal noise effects research expenditures is in support of community or collective response research. Although much has been done to relate noise and annoyance, most of the work has been related to conventional aircraft operations. Four agencies conduct research in this area (Table 5.7).

Table 5.7

FEDERAL RESEARCH FUNDING FOR COMMUNITY OR COLLECTIVE RESPONSE TO NOISE
(Thousands of Dollars)

Agency	FY 73	FY 74	FY 75
DOD	32	0	0*
NASA	378	491	654
DOT	0	130	50
HUD	0	200	410
Totals	410	821	1,114

* DOD FY 75 data estimated the same as FY 74.

Measurement Methodology and Calibration - Over 18 percent of the current expenditures for noise effects research is applied to this category. This research is conducted to support noise health effects research, support implementation of noise control legislation, and maintain a defensible posture regarding measurement technology. Six agencies conduct research in this important area as shown in Table 5.8.

Table 5.8

FEDERAL RESEARCH FUNDING FOR NOISE MEASUREMENT METHODOLOGY AND CALIBRATION
(Thousands of Dollars)

Agency	FY 73	FY 74	FY 75
HEW (NIOSH)	63	96	108
DOD	337	604	614*
HUD	117	438	50
EPA	24	32	0
DOI (BuMines)	0	15	0
NASA	532	409	404
Totals	1,073	1,594	1,176

* Estimated.

5.2 AIRCRAFT NOISE

Federal aircraft noise RD&D can be associated with support of and modification to existing standards and regulations and development and demonstration of technology for future regulations. Table 3.2 (p. 16) gave the major noise source categories for aircraft and Table 3.7 (p. 24) provided a summary of the status of existing aircraft noise standards and regulations and those in the process of being promulgated. Table 5.9 illustrates the distribution of Federal RD&D that supports (1) existing regulations, (2) technology demonstration for future regulation, and (3) research to develop technology for future regulations. When the noise source categories covered in these programs are considered, a comparison of Tables 3.2 (p. 16), 3.3 (p. 17), and 5.9 provides a preliminary understanding of how Federal aircraft noise RD&D relates to major aircraft noise source categories, existing standards and regulations, and development of technology for future standards and regulations.

The Federal RD&D supporting existing and future aircraft noise standards and regulations is summarized in Table 5.9 for fiscal years 1973 through 1976. Major activity supporting existing regulations has been conducted by DOT/FAA and NASA. Programs in this category are primarily concerned with the question of retrofitting older aircraft of the current commercial fleet which were not initially included in provisions of FAR Part 36 (See Table 3.7, p. 24). These questions are being resolved and, as a result, funding for these activities terminates in FY 75.

Table 5.9

FEDERAL RD&D SUPPORTING EXISTING AND FUTURE AIRCRAFT
NOISE STANDARDS AND REGULATIONS

Federal RD&D Support	Sponsoring Agency	Fiscal Year Funding (Thousands of Dollars) 1973	1974	1975	1976
Supporting Existing Regulations	NASA	28,170	25,209	5,905	--
	DOT/FAA	8,492	2,198	1,000	--
	EPA	-	404	-	--
	Total	(36,662)	(27,811)	(6,905)	(--)
Demonstrations Supporting Future Regulations	NASA	-	3,386	4,626	7,745
	DOD	-	500	675	275
	Total	(-)	(3,886)	(5,301)	(8,020)
Research Supporting Future Regulations	NASA	-	17,483	16,773	17,426
	DOD	-	1,786	1,282	1,112
	DOT/ONA	-	785	793	1,760
	Total	(-)	(20,054)	(18,848)	(20,298)

The table also shows the level of Federal funding for demonstrations which support development of future standards and regulations for various aircraft noise source categories. These programs are sponsored mainly by NASA and DOD. It can be observed that while funding for support of existing regulation decreases, funding for demonstrations to support future regulations is increasing and reaches about $8 million in FY 76.

The third section of Table 5.9 summarizes the Federal funding for basic research and technology development that is applicable to development of new standards and regulations. This includes modification to existing standards and regulations by lowering permissible noise levels and inclusion of additional major source categories. Total funding by NASA, DOT and DOD is relatively constant through fiscal years 1974, 1975, and 1976. The data for FY 76 are based on the agencies' projections and are subject to change in the process of refining program plans.

5.2.1 Support of Existing Standards and Regulations

The status of existing standards and regulations is summarized in Table 3.7 (p. 24). The Federal programs that support these standards are summarized in Table 5.10. In the first part of the table, those programs associated with aircraft type certification are listed and in the second part of the table, the activities related to aircraft operational procedures are given. The REFAN program conducted by NASA accounts for a great percentage of total funds supporting type certification. This program was initiated to develop and demonstrate retrofit kits for older, in-service turbojet aircraft and is scheduled for completion in FY 75. The retrofit feasibility for commercial jet aircraft conducted by the FAA under their Source Noise Reduction Program is being completed in FY 75. The FAA has recommended implementation of the Sound Absorbing Materials (SAM) retrofit alternative.

The major program that relates to flight procedures, Noise Reduction Flight Experiments, is being conducted by NASA and is scheduled for completion in FY 75. These activities are related to the flight procedures rules and regulations tabulated in Table 3.7 (p. 24).

5.2.2 Demonstrations Supporting Future Regulations

Federal programs which will provide demonstrated technology to support the regulatory process for various aircraft source types are listed in Table 5.11. The aircraft source types included in these programs are: wide body turbojets, STOL, VTOL, powered-lift and rotorcraft, including helicopters. A program to demonstrate a quiet, clean, general aviation turbofan engine is scheduled to be initiated in FY 76. Total funding for demonstration programs supporting future regulations is expected to

Table 5.10

FEDERAL RD&D SUPPORTING EXISTING AIRCRAFT NOISE STANDARDS AND REGULATIONS

Regulation/Standard	Description Title of Program	Sponsoring Agency	Fiscal Year Funding (Thousands of Dollars) 1973	1974	1975	1976
Aircraft Type Certification Including FAR Part 36, NPRM 74-14, NPRM 73-26, ANPRM 73-32	REFAN PROGRAM	NASA	24,463*	20,803	2,514	-
	Source-Noise Reduction	DOT/FAA	8,176	1,899	900	-
	Short Haul Transportation Systems Analysis	NASA	-	180	-	-
	Aircraft Noise Systems Studies	EPA	-	404	-	-
	Aerodynamics and Crash Worthiness	NASA	-	95	-	-
	General Aviation Technology	NASA	-	260	4,618	-
Aircraft Flight Procedures Including AC 91-39, ANPRM 74-12, AC 90-59, AC-91-36, FAR Part 91	Source and Operational Sonic Boom Reduction	DOT/FAA	316	299	100	-
	Noise Reduction Flight Experiments	NASA	3,405	3,600	1,380	-
	Terminal Configured Vehicle Operating Systems Experiments	NASA	302	271	1,563	-
	Total		36,392	27,811	6,905	-

* This figure includes funding prior to and including FY 73.

Table 5.11

FEDERAL NOISE CONTROL DEMONSTRATION PROGRAMS SUPPORTING FUTURE AIRCRAFT NOISE STANDARDS AND REGULATIONS

Aircraft Type Source	Descriptive Title of Program	Sponsoring Agency	Fiscal Year Funding (Thousands of Dollars) 1974	1975	1976
Wide Body Turbojet	Advanced Acoustic Composite Nacelle Program	NASA	530	560	1,090
STOL	Advanced Powered Lift Aircraft	NASA	310	1,480	1,470
STOL	Augmentor Wing Flight Experiment	NASA	160	-	-
STOL (Powered lift)	Quiet Clean Short Haul Experimental Engine (QCSEE)	NASA	167	840	825
STOL (Powered lift)	Quiet Propulsive Lift Technology	NASA	1,310	-	-
STOL	STOL Operating Systems Experiments	NASA	135	657	657
VTOL	VTOL Operating Systems Experiments	NASA	-	624	624
VTOL	Tilt Rotor Research Aircraft	NASA	274	-	-
Rotorcraft	Rotor Systems Research Aircraft	NASA	500	-	-
		DOD	500	675	275
Rotorcraft	Rotor Systems for RSRA	NASA	-	465	470
General Aviation Aircraft	Quiet, Clean, General Aviation Turbofan (QCGAT)	NASA	-	-	536

Table 5.11

FEDERAL NOISE CONTROL DEMONSTRATION PROGRAMS SUPPORTING FUTURE AIRCRAFT NOISE STANDARDS AND REGULATIONS
(Concluded)

Aircraft Type Source	Descriptive Title of Program	Sponsoring Agency	Fiscal Year Funding (Thousands of Dollars) 1974	1975	1976
General Aviation Aircraft	General Aviation Technology	NASA	-	-	460
CTOL	Terminal Configured Vehicle Operating Systems Experiments	NASA	-	-	1,613
	Totals		3,886	5,301	8,020

double in FY 76 compared to FY 74. Except for DOD involvement in one rotorcraft program, all programs are being conducted by NASA.

5.2.3 Research Supporting Future Standards and Regulations

The Federal aircraft noise research programs which can be associated with development of technology to support future regulations, including the lowering of permissible noise levels within existing regulations, are summarized in Table 5.12. These programs deal with the fundamental mechanisms of noise generation and prediction in propulsion, airflow-surface interaction including airframe aerodynamic noise, and rotors and propellors. Other programs involve structural response, sound propagation and systems studies for future subsonic, transonic and supersonic aircraft. The outcome of these programs governs the future level of noise control. For example, control of aircraft approach noise below FAR 36 minus 10 dB depends on reducing airframe aerodynamic noise. Note that NASA has a program addressing this problem.

While DOT and DOD have specific research programs, NASA has the most comprehensive coverage of all major noise source categories. About 90 percent of all research to support future regulations is being conducted by NASA.

5.3 SURFACE VEHICLE NOISE

The Federal surface vehicle RD&D activities can be related to support of existing or future regulations. Specifically, the Federal programs can be identified with the development and/or enforcement of existing or proposed surface vehicle noise regulations and with research and/or demonstration of surface vehicle noise control which could provide the basis for future regulations. Such an analysis allows a comparison of major surface vehicle noise source candidates identified in Table 3.4 (p. 18) with those sources which have been or are being addressed in the Federal surface vehicle noise RD&D activities. This comparison will provide the basis upon which conclusions and recommendations can be made concerning the current Federal surface vehicle noise RD&D activities.

The Federal surface vehicle RD&D resource allocations supporting the development and/or enforcement of existing or proposed standards and regulations (listed in Table 3.8, p. 26) are summarized in Table 5.13. Through FY 75 the Federal Government has committed an estimated $4,788,000 for RD&D supporting surface vehicle noise standards and regulations. Of this almost 70 percent was allocated to RD&D supporting standards and regulations development. The peak in the Federal commitments for RD&D support of both regulations development and enforcement was in FY 73 when over 40 percent of the total resources during the FY 73 through FY 75 was allocated. The two agencies sponsoring this research were DOT and EPA.

Table 5.12

FEDERAL RESEARCH PROGRAMS TO SUPPORT FUTURE AIRCRAFT NOISE STANDARDS AND REGULATIONS

Aircraft Type Source	Descriptive Title of Program	Sponsoring Agency	Fiscal Year Funding (Thousands of Dollars) 1974	1975	1976
All Aircraft Types	Basic Noise Research	NASA	3,994	3,461	3,700
All Aircraft Types	Noise Technology and Prediction	NASA	9,354	8,733	8,790
CTOL	Airframe Aerodynamic Noise	NASA	801	1,646	1,779
All Aircraft Types	Acceptance of Aircraft Operations	NASA	(1,154)	(1,200)	(1,458)
CTOL	Jet Noise Research Program	DOT/ONA	785	1,282	1,760
CTOL	Propulsion Noise Reduction	DOD	563	271	400
CTOL	Airflow Surface Interaction	DOD	272	75	125
CTOL	Structural Response and Sound Propagation Programs	DOD	917	447	587
Rotorcraft	Advanced Rotorcraft Aerodynamic Technology	NASA DOD	920 34	1,045 -	1,040 -
VTOL	Advanced VTOL Aircraft Aerodynamic Technology	NASA	80	150	160
Supersonic	Propulsion Technology	NASA	1,422	1,233	1,360
Supersonic	Aerodynamic Performance	NASA	664	257	370

Table 5.12

FEDERAL RESEARCH PROGRAMS TO SUPPORT FUTURE AIRCRAFT NOISE STANDARDS AND REGULATIONS
(Concluded)

Aircraft Type Source	Descriptive Title of Program	Sponsoring Agency	Fiscal Year Funding (Thousands of Dollars) 1974	1975	1976
CTOL	Analysis of Future Civil Transportation Systems and Concepts	NASA	88	168	147
CTOL	High Transonic Speed Transport System Study	NASA	16	80	80
C/RTOL	Subsonic/Transonic/C/RTOL Transport Technology Systems & Design Studies	NASA	110	-	-
Supersonic & CTOL	Subsonic/Sonic Transportation Technology Propulsion Studies	NASA	34	-	-
	Totals		20,054	18,848	20,298

Table 5.13

FEDERAL NOISE RD&D SUPPORTING THE DEVELOPMENT AND ENFORCEMENT OF EXISTING SURFACE VEHICLE STANDARDS AND REGULATIONS

Federal RD&D Support	Sponsoring Agency	Fiscal Year Funding (Thousands of Dollars) Prior to 1973	1973	1974 (est)	1975*	Total
Development of Standards and Regulations	DOT	1,589	892	292	200	2,973
	EPA	-	170	178	+	348
	(Totals)	(1,589)	(1,062)	(470)	(200)	(3,321)
Enforcement of Standards and Regulations	DOT (Totals)	(199)	(868)	(350)	(50)	(1,467)
	GRAND TOTAL	1,788	1,930	820	250	4,788

However, DOT was the only agency providing research and technology supporting both development and enforcement of standards and regulations. DOT's commitments were $4,440,000, almost 93 percent of the total Federal allocations.

The Federal resource allocations which are considered to be applicable to future standards and regulations are shown in Table 5.14. The total amount allocated through FY 75 was $5,297,000, the same order of magnitude as that for RD&D supporting existing standards. Of this, approximately 60 percent is for RD&D programs which are designed to yield demonstrated noise control technology or techniques, and the remaining 40 percent for research into the fundamentals of noise generation, measurement, and control. The total RD&D supporting future regulations is shown to peak in FY 74 at $2,554,000, accounting for just over 48 percent of the estimated total through FY 75.

The agencies sponsoring RD&D applicable to future surface vehicle standards and regulations are DOT, DOD, NSF, and USDA. DOT is the major contributor, allocating an estimated $3,270,000 or almost 62 percent of the total Federal RD&D resources for future surface vehicle regulations. Based on the distribution of resources, DOT places almost equal emphasis on research and demonstration programs. DOD places most of its emphasis on demonstration programs. DOD's total allocation to RD&D supporting future regulations is $1,609,000, or just over 30 percent of the total. USDA and NSF together contribute $418,000 to the total with USDA allocating all of its resources to demonstration programs and NSF assigning all its resources to research.

Through FY 75 the Federal Government has allocated at least $10,085,000 for RD&D to support surface vehicle (principally transportation) standards and regulations. Of the total, $4,788,000 or about 48 percent has been devoted to support of the development and enforcement of existing standards and regulations. The remaining $5,297,000 (52 percent) can be assigned to Federal RD&D to support the development of future standards and regulations. Of the four agencies sponsoring surface vehicle RD&D, DOT is the principal agency, allocating $7,710,000 or over 76 percent of the total. DOD sponsors the second largest amount of surface vehicle noise RD&D, having committed a total of $1,609,000 through FY 75. Together, DOT and DOD account for almost 98 percent of the total Federal allocations. Table 5.15 identifies the manner in which the major sources of surface vehicle noise is being addressed by the current Federal RD&D programs.

5.3.1 Development of Existing Regulations

The Federal RD&D programs which have supported the development of existing or proposed surface vehicle-related noise standards and regulations are identified in Table 5.16. The majority of this Federal

Table 5.14

FEDERAL NOISE RD&D PROVIDING SUPPORT FOR FUTURE SURFACE VEHICLE NOISE STANDARDS AND REGULATIONS

Federal RD&D Support	Sponsoring Agency	Prior to 1973	Fiscal Year Funding (Thousands of Dollars) 1973	1974 (est)	1975	Totals
Noise Control Demonstration for Future Standards and Regulations	DOT	159	183	1,079	390	1,811
	DOD	-	584	570	160	1,314
	USDA	-	4	73	39	116
	(Totals)	(159	(771)	(1,722)	(589)	(3,241)
Research for Future Standards and Regulations	DOT	119	410	435	495	1,459
	DOD	100	100	95	-	295
	NSF	-	510	302	-	302
	(Totals)	(219)	(510)	(832)	(495)	(2,056)
	GRAND TOTALS	378	1,281	2,554	1,084	5,297

Table 5.15

SUMMARY OF FEDERAL SURFACE VEHICLE NOISE RD&D SUPPORT OF FEDERAL SURFACE VEHICLE STANDARDS AND REGULATIONS

Sources	Regulations		Federal RD&D Programs	
	Existing	Proposed	Demonstration	Research[1]
Highways[2]	X		X	X
Railways[2]			X	X
Highway Vehicles:				
Medium- & Heavy-Duty Trucks	X		X	X
Truck Tires			X	X
Motorcycles		X		
Buses		X	X	
Automobiles				
Automobile Tires[2]			X	
Light Trucks				
Construction Vehicles:				
Dozers (Tracked & Wheeled)		X	X	
Loaders (Tracked & Wheeled)		X	X	
Graders			X	
Recreational Vehicles:				
Snowmobiles			X	
Motorcycles (off road)				
Motor Boats				
Railway Vehicles:				
Railroad Locomotives	X		X	
Railroad Cars	X			
Rapid Rail Transit			X	X

[1] Some of the DOD research is classified.

[2] Not identified by EPA as a major noise source candidate.

Table 5.16

FEDERAL RD&D SUPPORTING DEVELOPMENT OF EXISTING SURFACE VEHICLE NOISE STANDARDS & REGULATIONS

Regulation/Standard	Descriptive Title of Program	Sponsoring Agency	Fiscal Year Funding (Thousands of Dollars) Prior to 1973	1973	1974 (est)	1975[1]
All Surface Transportation	Magnitude of Transportation Noise General & Potential Abatement	DOT	++	--	--	--
Trucks (exterior)	Quiet Truck Program	DOT	1,046	100	100	--
	Truck/Bus Retrofit	DOT	--	450	72	--
	Exhaust/Intake Mufflers	DOT	75	28	--	--
	Truck Noise Handbook	DOT	--	15	20	--
	Truck Tire Noise Study	DOT	468	100	100	200
	Interstate Motor Carrier Regulation	EPA	--	170	+	+
	New Medium-& Heavy-Duty Truck Regulation	EPA	--	--	178	+
	(Total)		(1,589)	(863)	(470)	(200)
Trucks (interior)	In-Cab Noise Tests	DOT	--	--	--	--
Highways	Development of Highway Noise Standards PPM 90-2	DOT	+	+	+	--

Table 5.16

FEDERAL RD&D SUPPORTING DEVELOPMENT OF EXISTING
SURFACE VEHICLE NOISE STANDARDS & REGULATIONS
(Concluded)

Regulation/Standard	Descriptive Title of Program	Sponsoring Agency	Fiscal Year Funding (Thousands of Dollars) Prior to 1973	1973	1974 (est)	1975[1]
Railway Carrier	Measurement of Railroad Noise	DOT	++	++	--	--
	Interstate Rail Carrier Regulation	EPA	--	199	--	--
	GRAND TOTAL		1,589	1,062	470	200

1 FY estimates known to be incomplete.

+ Primarily an in-house effort.

++ Program not dedicated to surface vehicle noise, resource allocations not available.

effort has been to establish demonstrated control methods for noise emitted externally and at low speeds from existing and new medium- and heavy-duty trucks used in interstate commerce. These trucks are considered to be the major environmental surface vehicle noise source. In addition to external truck noise, there has been RD&D to support the motor carrier safety regulations limiting operator exposure to interior noise levels.

DOT in-house research provided information that was incorporated in the highway noise control standards and procedures regulation which provides guidelines for planning and design of highways. Other Federal RD&D programs provided support for the interstate rail carrier regulations which placed noise limitations principally on the locomotive. It should be noted that some of this work was not dedicated to railway carrier noise.

5.3.2 Enforcement of Existing Regulations

The Federal research programs supporting the enforcement of existing regulations are listed in Table 5.17. By far the emphasis in the Federal effort has been in training and development of measurement and prediction tools and techniques for enforcing the highway and motor carrier truck noise regulations. Portions of Federally sponsored research has been identified with the enforcement of the interstate rail carrier regulation.

5.3.3 Demonstration Programs for Future Regulations

There are a number of Federal RD&D programs which are designed to provide demonstrated noise control technology and/or techniques and thereby have potential for providing a basis for future surface vehicle noise source standards and regulations. These studies encompass a broad range of surface vehicle sources of noise, including highways, railways, highway and off-highway vehicles, and railway vehicles. Table 5.18 identifies the current Federal demonstration programs in each of these source categories.

The programs addressing highway noise are principally concerned with the demonstration of the effectiveness of noise control through the use of various barriers and highway design tools and techniques. For railway noise, the principal efforts in the Federal programs have been to determine the noise climate of existing rail transit systems. However, one program is designed to demonstrate the effectiveness of retarder barriers to control noise from railroad yards.

For support of future highway vehicle regulations, the interior and exterior noise levels of many military fleet vehicles have been measured. Included in this work have been measurements of the component noise sources of a cargo truck and noise levels of non-directional cross country and new military tires. Other related programs have involved the measurement

Table 5.17

FEDERAL RESEARCH PROGRAMS SUPPORTING REGULATIONS ENFORCEMENT

Regulation/Standard	Descriptive Title of Program	Sponsoring Agency	Fiscal Year Funding (Thousands of Dollars) Prior to 1973	1973	1974(est)	1975[1]
Trucks & Highway	Highway Noise Enforcement Training and Equipment	DOT	--	450	70	--
	Roadside Enforcement Sites	DOT	--	--	100	50
	BMCS Training/Equipping	DOT	--	--	--	--
	PPM 90-2 Training Manual & Course	DOT	--	132	+	+
	NCHRP Project III	DOT	120	120	180	-
	Scale Modelling Highway Noise	DOT	79	--	--	--
	Scale Modelling Urban Traffic Noise	DOT	--	112	--	--
	FHWA Highway Design Manual	DOT	--	54	--	--
Railway	Joint DOT/AAR Noise Research	DOT	--	--	--	--
		Total	199	868	350	50

1 FY 75 estimates known to be incomplete.

+ Primarily an in-house effort.

Table 5.18

FEDERAL NOISE CONTROL DEMONSTRATION PROGRAMS
SUPPORTING FUTURE STANDARDS AND REGULATIONS

Surface Vehicle Noise Source	Descriptive Title of Program	Sponsoring Agency	Fiscal Year Funding (Thousands of Dollars) Prior to 1973	1973	1974 (est)	1975[1]
Highways:						
	Barrier Parametrics	DOT	+	+	50	+
	Highway Barrier Effectiveness	DOT	43	7	--	--
	Acoustic Materials Applications	DOT	--	--	115	110
	Community Noise Study	DOT	16	20	20	--
	Traffic Noise Study	DOT	43	37	37	--
	The Use of Trees & Shrubs in Noise Abatement	USDA	--	--	20	--
	(Total)		(102)	(64)	(242)	(110)
Railways:						
Rapid Rail Transit	In-Service Noise Abatement Test Evaluation[2]	DOT	See below			
	Rapid Transit System Noise Environment	DOT	+	--	--	--
	New York City Transit System Study	DOT	--	--	125	--
	Chicago Transit Authority Studies	DOT	--	--	60	--
	Other Transit Authority Studies	DOT			120	--

Table 5.18

FEDERAL NOISE CONTROL DEMONSTRATION PROGRAMS
SUPPORTING FUTURE STANDARDS AND REGULATIONS
(continued)

Surface Vehicle Noise Source	Descriptive Title of Program	Sponsoring Agency	Fiscal Year Funding (Thousands of Dollars) Prior to 1973	1973	1974 (est)	1975[1]
	Joint DOT/AAR Noise Research[2]	DOT	See below			
	(Total)		(+)	(--)	(305)	(--)
Highway Vehicles:						
Military	Conformance with Regulatory Requirements	DOD	--	215	270	--
Truck Tires	Truck Tire Noise Study	DOT		--	--	--
Passenger Car Tires	Passenger Car Tire Noise	DOT	--	3	+	--
Buses	Purchase Specifications - Transit Coaches	DOT	--	--	22	--
	Transit Bus Noise Reduction Potential	DOT	--	26	--	--
	Truck/Bus Retrofit	DOT		--	--	--
	Transbus Program	DOT	++	++	++	++
	(Total)		(++)	(244)	(292)	(++)

Table 5.18

FEDERAL NOISE CONTROL DEMONSTRATION PROGRAMS
SUPPORTING FUTURE STANDARDS AND REGULATIONS
(continued)

Surface Vehicle Noise Source	Descriptive Title of Program	Sponsoring Agency	Fiscal Year Funding (Thousands of Dollars) Prior to 1973	1973	1974 (est)	1975[1]
Off-Highway Vehicles:						
Construction & Highway Maintenance	Construction Equipment Mufflers	DOT	--	--	50	--
	Construction Equipment Standards	DOT	57	90	80	80
	Noise Reduction Program for U.S. Army Construction Vehicles	DOD	--	369	300	160
Farm Equipment	Noise Vibration of Off-Road Equipment	USDA	--	4	28	--
Snowmobiles	Reduction of Vehicle & Equipment Noise Levels	USDA	--	--	25	39
	(Total)		(57)	(463)	(483)	(279)

Table 5.18

FEDERAL NOISE CONTROL DEMONSTRATION PROGRAMS
SUPPORTING FUTURE STANDARDS AND REGULATIONS
(concluded)

Surface Vehicle Noise Source	Descriptive Title of Program	Sponsoring Agency	Fiscal Year Funding (Thousands of Dollars) Prior to 1973	1973	1974 (est)	1975[1]
Railway Vehicles:						
Locomotives	Joint DOT/AAR Noise Research[2]	DOT	--	--	150	200
Rapid Rail Transit	In Service Noise Abatement Test and Evaluation[2]	DOT	--	--	250	--
	State-of-the-Art Car	DOT	++	++	++	++
	New System Specifications - Capital Grants	DOT	++	++	++	++
	(Total)		(++)	(++)	(400)	(200)
	GRAND TOTAL		159	771	1,722	589

1 FY 75 estimates known to be incomplete.
2 This program is multifaceted and has potential applications to many areas.
+ Primarily an in-house effort.
++ Not dedicated to surface vehicles noise, resource allocations not available.

of the noise levels of truck and passenger car tires. Although not all programs are specific to noise, there is a major Federal effort which is designed to provide demonstrated noise control technology for highway buses.

Off-highway surface vehicle noise sources are currently receiving the greatest noise dedicated emphasis in the Federal demonstration programs. Off-highway vehicles receiving the most attention are those used in construction. Specifically, low-noise mufflers and cooling system technology for medium- and heavy-duty trucks are being examined for applications to diesel-powered construction equipment. In addition, a number of military construction vehicles, including wheeled and crawler tractors, graders, loaders, rough terrain fork lifts, and a warehouse fork lift have been studied to demonstrate control technology to reduce the driver noise exposure and external noise emissions. Other Federal programs are addressing the control of noise from snowmobiles and farm equipment.

For railway vehicles there are major Federal efforts directed toward the demonstration of noise control techniques; e.g., resilient wheels and fastners, and other control technology for transit system noise through in-service testing and new system specifications. Another multifaceted Federal program includes the identification and characterization of locomotive noise and component noise sources under various operating modes.

5.3.4 Research Programs for Future Regulations

The Federal surface vehicle noise research programs which have been identified for support of future standards and regulations are listed in Table 5.19. These programs are distinguished by their consideration of the fundamentals of noise generation and control and therefore have potential for identifying the limits to noise control methods and technology. In addition, the results of these programs will also aid in establishing the ultimate goals for surface vehicle noise sources control.

The emphasis in the Federal surface vehicle research activities is in transportation vehicles. However, there are significant efforts identified which address the transmission of noise from highways and urban areas and the silencing of military vehicles used in transportation and construction. For highway transportation vehicles, the major efforts are concerned with component sources of medium- and heavy-duty truck noise. For rail transportation vehicles, the emphasis is in noise generated by wheel/rail interaction and in tracked rapid transit systems for the future.

Table 5.19

FEDERAL RESEARCH PROGRAMS TO SUPPORT FUTURE SURFACE VEHICLE NOISE STANDARDS AND REGULATIONS

Surface Vehicle Noise Source	Descriptive Title of Program	Sponsoring Agency	Fiscal Year Funding (Thousands of Dollars) Prior to 1973	1973	1974 (est)	1975[1]
Highways	Effects of Buildings and Other Boundaries on Motor Vehicle Noise	NSF	--	--	30	--
Transportation Vehicles	Noise and Vibration from Transportation Vehicles & Other Machinery	NSF	--	--	272	--
Military Transportation and Construction Vehicles	Vehicle Signature Reduction[2]	DOD/Army	100	100	95	--
Trucks	Truck Tires Noise Basic Research	DOT	119	--	150	250
	Engine Noise Support	DOT	--	80	40	--
	Basic Engine Noise Reduction	DOT	--	--	245	245
Rapid Rail Transit Vehicles	Wheel/Rail Noise & Vibration Study	DOT	--	184	--	--
	Elevated Structures Noise Vibration	DOT	--	146	--	--

Table 5.19

FEDERAL RESEARCH PROGRAMS TO SUPPORT FUTURE SURFACE VEHICLE NOISE STANDARDS AND REGULATIONS
(concluded)

Surface Vehicle Noise Source	Descriptive Title of Program	Sponsoring Agency	Fiscal Year Funding (Thousands of Dollars) Prior to 1973	1973	1974 (est)	1975[1]
Future Transit Systems	Personal Rapid Transit Program	DOT	++	++	++	++
	Linear Induction Motor Research Vehicle	DOT	++	++	++	++
	Magnetically Levitated Research Vehicle	DOT	--	--	+	+
	Tracked Air Cushion Research Vehicle	DOT	++	++	++	++
	Screech Loop-Pueblo Facility	DOT	+	+	++	++
	Dual Mode Program	DOT	--	--	++	++
	Totals		219	510	832	495

[1] FY 75 estimates known to be incomplete.
[2] This is a classified military program.
+ Primarily in-house effort.
++ Program not dedicated to noise, resource allocation not available.

5.4 MACHINERY NOISE

Federal machinery noise RD&D can be identified which has supported the development of the proposed regulation for new portable air compressors. The remainder can be associated with support of future standards and regulations and can be classified as either research to develop new or advanced noise control technology or RD&D to demonstrate available technology. Table 5.20 summarizes the Federal expenditures in each of these categories for FY 73 - FY 75. In FY 73 - 75, the Federal Government spent about $4,725,000 for RD&D in machinery noise.* Of this total $388,000, or 8 percent, was expended on RD&D which has supported the EPA proposed noise standard for new portable air compressors; $705,000, or 15 percent of the total, supported research to develop advanced technology for noise control; and the remaining $3,632,000, or 77 percent of the total, went toward demonstration of available technology.

Table 5.21 summarizes the Federal machinery noise RD&D in FY 73 - FY 75 which addresses candidates for identification as major sources of environmental noise (identified in Table 3.5, p. 19). These activities accounted for $1,431,000, or 30 percent of the total Federal machinery noise RD&D expenditures during that period. EPA is expected to identify two of these sources, lawnmowers and pneumatic and hydraulic tools, as major noise sources in the near future. In the case of lawnmowers, the activity involves only the development of a measurement methodology. It should also be noted that the work on saws and home appliances is research on fundamental noise generation and control.

5.4.1 Development of the Proposed Regulations

The Federal research activities which have supported the development of the EPA proposed noise emission standard for new portable air compressors are identified in Table 5.22. The majority of this RD&D was sponsored by EPA to develop information on cost, technology, and measurement methodology in direct support of the development and enforcement of the standard. The U. S. Army's Mobility Equipment Research and Development Center (MERDC) sponsored the only Federal RD&D which demonstrated available control technology for a portable air compressor (600 CFM). EPA also supported other related research on construction site noise to develop information from which EPA-identified portable air compressors as a major source of construction site noise (along with medium- and heavy-duty trucks).

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* This total does not reflect about $1 million spent annually by the U. S. Navy for machinery noise RD&D. The Navy program which is directed toward quiet ships is classified.

Table 5.20

SUMMARY OF FEDERAL MACHINERY NOISE RD&D PROPOSED AND FUTURE STANDARDS AND REGULATIONS

Federal RD&D Support	Fiscal Year Funding (Thousands of Dollars) 1973	1974	1975	Total
Proposed Portable Air Compressor Regulation	158	230	0	388
Research on Advanced Noise Control Technology for Support of Future Standards and Regulations	243	423	39	705
RD&D which Provides Demonstrated Noise Control Technology for Support of Future Standards and Regulations	570	1,531	1,531	3,632
Totals*	971	2,184	1,570	4,725

* These totals do not reflect the $1 million Navy RD&D program to quiet ships. Details cannot be reported for security reasons.

Table 5.21

SUMMARY OF FEDERAL MACHINERY NOISE R&D ON MAJOR NOISE SOURCE CANDIDATES

Source	Demonstration	Research	Sponsoring Agency	Fiscal Year Funding (Thousands of Dollars) 1973	1974	1975	Totals
Lawnmowers[1]	X[2]		CPSC	0	15	0	15
Pneumatic and Hydraulic Tools[1]	X		EPA, BuMines	157	152	200[3]	509
Generators	X		DOD/USA/MERDC	80	50	0	130
Pumps[4]	X		DOD/USA/MERDC	0	0	0	0
Rock Drills	X		BuMines	90	0	0	90
Saws[5]		X	NSF	87[5]	0	0	87
Air Conditioners	X		DOD/USA/MERDC	0	400	200	600
Home Appliances[6]		X	NSF	0	272[6]	0	272
Totals				414	617	400	1,431

1 Expected to be identified as major sources in the near future.
2 Measurement methodology only.
3 Includes $100K projected by Bureau of Mines.
4 Work included in surface vehicle, but applicable to stationary pumps.
5 Basic work which includes sawblades as well as other sources. Funding is for 18 months.
6 Majority of work is surface vehicle and funding is not included in these totals. Appliances are discussed in the project description, but no specific sources were identified.

Table 5.22

FEDERAL RD&D SUPPORTING DEVELOPMENT OF THE EPA PROPOSED REGULATION ON PORTABLE AIR COMPRESSORS

Descriptive Title	Sponsoring Agency	Fiscal Year Funding (Thousands of Dollars) 1973	1974	1975
Compressor Noise Control	DOD/USA/MERDC	98	0	0
Portable Air Compressor Noise Technology and Cost	EPA	0	91	0
Construction Noise Study	EPA	0	25	0
Economic Impact of Portable Air Compressor Noise Emission Standards	EPA	0	50	0
Development of Noise Measurement Methodology for Portable Air Compressors	EPA	60	64	0
Totals		158	230	0

The Federal research activities on advanced noise control technology which can support future standards and regulation are listed in Table 5.23. These activities are distinguished by their consideration of the fundamentals of noise generation, propagation, and control and therefore have potential for identifying the limits to noise control methods and technology. In addition, the results of these activities will also aid in establishing the ultimate goals for control of some major machinery noise sources.

Two agencies, NIOSH and NSF, have activities in this area. NIOSH has supported fundamental work on punch presses and wood planers. NSF sponsors research based on the merits of unsolicited proposals. In FY 73 and FY 74 NSF funded 13 grants adressing noise generating mechanisms, propagation, and noise control fundamentals.

Table 5.23

FEDERAL RESEARCH TO SUPPORT FUTURE
NOISE STANDARDS AND REGULATIONS

Machinery Noise Sources	Activity Title	Sponsoring Agency	Fiscal Year Funding (Thousands of Dollars) 1973	1974	1975
Punch Presses	Punch Press Noise Reduction	NIOSH	-	54	-
Wood Planers	Noise Control Research in Wood Planers	NIOSH	-	52	39
Heat Exchangers	Flow Induced Vibration and Noise in Heat Exchangers	NSF[1]	-	65.4[2]	-
Pipelines	Cavitation Damage Scale Effects for sudden Enlargements in Pipelines	NSF[1]	74.5[2]	-	-
Basic Generation Mechanism	Research Initiation-Impact Mechanics and the Generation of Impulsive Sound	NSF[1]	17[3]	-	-
Sawblades, Blowers	Basic and Applied Studies of Noise	NSF[1]	87[3,5]	-	-
Ducts and Nozzles	Attenuation of High-Intensity Sound in a Condensing Vapor	NSF[1]	-	26	-
Combustion	Combustion Generated Noise[4]	NSF	-	-	-
Diesel Engines	Controlling the Noise Radiated from Diesel Engines[4]	NSF	-	-	-
Appliances Machine Tools	Noise and Vibration from Transportation Vehicles and Other Machinery	NSF[1]	-	272[6]	-

Table 5.23

FEDERAL RESEARCH TO SUPPORT FUTURE
NOISE STANDARDS AND REGULATIONS
(concluded)

Machinery Noise Sources	Activity Title	Sponsoring Agency	Fiscal Year Funding (Thousands of Dollars) 1973	1974	1975
Basic Propagation	Acoustic Propagation in Branches Solids	NSF[1]	49.5	74[2]	-
Basic Propagation	Sound Transmission in Buildings	NSF[1]	15	-	-
Basic Propagation	Research on Noise Propagation	NSF[1]	-	152[2]	-
Basic Control	Acoustically Absorbent Materials[4]	NSF	-	-	-
Basic Control	Optimum Design of Partitions for Minimum Sound Transmission[4]	NSF	-	-	-
	Totals		243	423	39

1 NSF funding cannot be predicted for FY 75.
2 Funding for 24-month period.
3 Funding for 18-month period.
4 Funding in FY 72 for 24-month period.
5 Includes some minor surface vehicle related work.
6 Majority of work is surface vehicles. Funding is included in that section.

5.4.3 Demonstration of Technology for Future Regulations

There is Federal RD&D which is designed to provide demonstrated noise control technology and/or techniques and thereby has potential for providing a basis for machinery noise source standards and regulations in the near future. Table 5.24 lists these activities. It should be noted that a significant portion is involved with measurement of methodology.

Eight agencies, DOD, NBS, NSF, BuMines, NIOSH, EPA, CPSC, and USDA, have activities in this category, and a number of machinery noise sources are addressed. DOD addresses several kinds of military equipment: generators, air conditions, hydraulic equipment, and construction equipment. NBS develops measurement methodology for machinery noise sources and designs guidelines for noise control in buildings. NSF has funded development of a computer model to predict industrial noise levels. The Bureau of Mines RD&D addresses a number of sources in the mining environment. NIOSH has supported (1) identification of available technology for industry in general, (2) identification of available technology for the textile industry specifically, (3) the identification of noise control materials and their capabilities, and (4) the development of a recording system for impulse noise. EPA is planning work to identify available control technology, costs, and economics for regulation of pneumatic and hydraulic tools. CPSC has supported development of measurement methodologies for regulation of (1) various consumer products, (2) lawnmowers, and (3) toys. USDA began a program in 1974 to study noise from agricultural machinery.

5.5 NOISE MEASUREMENT RD&D

A critical area to the success of all the Federal Government's efforts to control aircraft, surface vehicle, and machinery noise and to develop noise effects criteria is the RD&D of the instrumentation and methodologies for measuring, characterizing, and monitoring noise and for enforcing noise standards and regulations. This is apparent from Table 5.25 which shows that all 11 of the Federal agencies and departments involved in noise RD&D also sponsor RD&D of noise measurements methodology and/or instruments for noise measurements. The allocations have ranged from 1.5 to 2.3 million dollars per year during the FY 73 to FY 75 time period excluding those related to aircraft noise measurements.

Of the research/source categories shown in Table 5.26, noise measurements RD&D support of noise effects research receives the greatest emphasis based on known resource allocations. A major portion of the effects measurements RD&D concerns aircraft noise. In addition, it is known from the Interagency Aircraft Noise Research Panel report on Federal aircraft noise RD&D programs that the agencies involved also

Table 5.24

FEDERAL MACHINERY NOISE CONTROL DEMONSTRATION ACTIVITIES
SUPPORTING FUTURE STANDARDS AND REGULATIONS

Machinery Noise Source	Activity Title	Sponsoring Agency	Fiscal Year Funding (Thousands of Dollars) 1973	1974	1975
Electric Generator	Electric Generator Noise Control	DOD/USA/MERDC	80	50	-
Air Conditioner	Air Conditioner Noise Control	DOD/USA/MERDC	-	400	200
Hydraulic Equipment	Hydraulic Noise[1]	DOD/USA/MERDC	-	-	-
Construction Euqipment	Construction Equipment: Specification and Control	DOD/USA/CERL	-	40	45
Measurement Methodology	Machinery Noise Measurement Methods	NBS	41	120	120
Building Sources	Building Accoustics	NBS	97	144	145
Industrial Sources	Prediction of Noise Levels in Manufacturing Areas	NSF	-	39[2]	-
Mine Conveyors	Alternate Conveyor Designs for Mine Machinery	BuMines[3]	-	148.8	-
Mine Cleaning Plant Sources	Noise Control in Surface Mining Facilities--Problem Definition	BuMines	79.4	16.7	-
Mine Surface Facilities' Chutes and Screens	Noise Control in Surface Mining Facilities: Chutes and Screens	BuMines	-	112.4	-

Table 5.24

FEDERAL MACHINERY NOISE CONTROL DEMONSTRATION ACTIVITIES
SUPPORTING FUTURE STANDARDS AND REGULATIONS
(continued)

Machinery Noise Source	Activity Title	Sponsoring Agency	Fiscal Year Funding (Thousands of Dollars) 1973	1974	1975
Pneumatic Rock Drills	Abatement of Noise from Pneumatic Rock Drills	BuMines	90.1	-	-
Pneumatic Drills	Muffler for Pneumatic Drill: 1. Analysis and Design 2. Analysis of Mechanical Noise 3. Abatement of Mechanical Noise 4. Larger Class Drill	BuMines	56.6	15.1	-
Measurement and Pneumatic Drill	Problem of Coal Mine Noise Generation and Correction	BuMines	100.2	137.3	-
Bolters, Loaders, Continuous Miners	Noise Abatement in Mining Machinery	BuMines	10.4	39.5	-
Diesel-Powered Mining Equipment	Noise Control of Underground Diesel-Powered Equipment--Problem Definitions	BuMines	-	58.7	-
Mine Sources	FY 75 Projected	BuMines[3]	-	-	730
Textile Machines	Coordinated Textile Industry Noise Reduction Program	NIOSH	-	120	99.5
Industrial Sources	Industrial Noise Control Manual	NIOSH	16	-	-

Table 5.24

FEDERAL MACHINERY NOISE CONTROL DEMONSTRATION ACTIVITIES
SUPPORTING FUTURE STANDARDS AND REGULATIONS
(continued)

Machinery Noise Source	Activity Title	Sponsoring Agency	Fiscal Year Funding (Thousands of Dollars) 1973	1974	1975
Available Materials	Compendium of Noise Control Materials[4]	NIOSH	-	-	-
Impulse Sources	Impulse Noise Recording Systems[2,5]	NIOSH	-	-	-
Pneumatic and Hydraulic Tools	Pneumatic and Hydraulic Drills and Pavement Breakers - Technology, Costs, and Economic Impact	EPA	-	-	100
Consumer Products	Developing a Consistent Set of Product Noise Regulations	CPSC	-	20	0
Lawnmowers	Test Protocol for Lawnmower Noise	CPSC	-	15	0
Toys	Noise Measurement Techniques for Noise	CPSC	-	35	0

Table 5.24

FEDERAL MACHINERY NOISE CONTROL DEMONSTRATION ACTIVITIES
SUPPORTING FUTURE STANDARDS AND REGULATIONS
(concluded)

Machinery Noise Source	Activity Title	Sponsoring Agency	Fiscal Year Funding (Thousands of Dollars) 1973	1974	1975
Agricultural Machinery	Abatement and Control of Noise Associated with Agricultural Processes	USDA	-	20	92
	Totals		570	1,531	1,531

[1] Work carried out relative to surface vehicles but applicable to machinery noise. Covered in surface vehicle section.

[2] Funding for 24 months.

[3] FY 75 total was projected, but not identifiable with specific sources.

[4] Funding in FY 72 but work carried out in FY 73 and FY 74.

[5] Nominal in-house funding.

Table 5.25

SUMMARY OF FEDERAL NOISE MEASUREMENTS
RD&D BY AGENCY

Agency	Fiscal Year Funding (Thousands of Dollars) 1973	1974	1975
DOD*	381	644	659
NASA*	532	409	404
DOT*	450	170	50
HUD	117	438	50
EPA	107	108	-
NBS	41	120	120
DOI/BuMines	179	169	-
USDA	-	20	92
HEW/NIOSH	63	96	108
CPSC	-	70	-
NSF	-	39	-
Totals	1,870	2,283	1,483

* Aircraft noise measurements RD&D not related to noise effects are not included.

Table 5.26

SUMMARY OF FEDERAL NOISE MEASUREMENTS
RD&D BY RESEARCH CATEGORY

	Fiscal Year Funding (Thousands of Dollars)		
Research Category	1973	1974]	1975
Noise Effects	1,073	1,594	1,176
Aircraft*	--	--	--
Surface Vehicle	517	182	50
Machinery	280	507	257
Totals	1,870	2,283	1,483

*Breakout of resources for Federal aircraft noise measurements RD&D not related to noise effects are not available.

sponsor supporting noise measurements RD&D. However, a breakout of these allocations is not possible at this time. While most of the known Federal allocations for noise measurements RD&D is to support other noise research activities, practically all of the measurements RD&D related to surface vehicle noise support enforcement of surface transportation regulations.

A summary of the noise measurements RD&D projects in each of the research/source categories identified in Table 5.26 is provided in Appendix E. Details of these projects can be obtained from the appropriate interagency panel report on the Federal noise RD&D activities.

6.0 APPENDICES

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APPENDIX A

GLOSSARY OF ACRONYMS AND TERMS

GLOSSARY OF ACRONYMS AND TERMS

AAR	- Association of American Railroads
AMC	- Army Materiel Command
AMST	- Advanced Medium STOL Transport
ARC	- Ames Research Center/NASA
ASHO	- Association of State Highway Officials
BMCS	- Bureau of Motor Carrier Safety/DOT
BuMines	- Bureau of Mines/DOI
CPSC	- Consumer Product Safety Commission
C/RTOL	- Conventional/Reduced Take Off and Landing
CSRS	- Cooperative State Research Service/USDA
CTOL	- Conventional Take Off and Landing
DOC	- Department of Commerce
DOD	- Department of Defense
DOI	- Department of Interior
DOL	- Department of Labor
DOT	- Department of Transportation
EPA	- Environmental Protection Agency
EPNdB	- Effective Perceived Noise Level in dB
FAA	- Federal Aviation Administration
FAR-36	- Federal Aviation Rule, Part 36
FHWA	- Federal Highway Administration/DOT
FRC	- Flight Research Center/NASA
FY	- Fiscal Year

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HEW - Department of Health, Education, and Welfare

HiTST - High Transonic Speed Transport

HRB - Highway Research Board/ASHO

HUD - Department of Housing and Urban Development

JP-Fuel - Jet Petroleum Fuel

JPL - Jet Propulsion Laboratory/NASA

L/D - Lift Drag Ratio

LaRC - Langley Research Center/NASA

LeRC - Lewis Research Center/NASA

MERDC - U.S. Army Mobility Equipment Research and Development Center/DOD

MVMA - Motor Vehicle Manufacturers Association

NADC - Naval Air Development Center/DOD

NAS - National Academy of Sciences

NASA - National Aeronautics and Space Administration

NBS - National Bureau of Standards

NFPA - National Fluid Power Association

NIEHS - National Institute of Environmental Health Sciences/HEW

NINDS - National Institute of Neurological Diseases and Stroke/HEW

NIOSH - National Institute for Occupational Safety and Health/HEW

NRC - National Research Council

NSF - National Science Foundation

ONAC - Office of Noise Abatement and Control/EPA

ORD - Office of Research and Development/EPA

OSHA - Occupational Safety and Health Administration/DOL

OVSR - Office of Vehicle Systems Research/NBS

QCSEE - Quiet Clean Short-Haul Experimental Engine

QSRA - Quiet Short-Haul Research Aircraft

RADC - Air Force Rome Air Development Center/DOD

RD&D - Research, Development, and Demonstration

RSRA - Rotor Systems Research Aircraft

RTOL - Reduced Take Off and Landing

RTOP - Research and Technology Operating Plan/NASA

SAE - Society of Automotive Engineers

SAM - Sound Absorbing Material

SCAR - Supersonic Cruise Aircraft

STOL - Short Take Off and Landing

TACOM - U.S. Army Tank Automotive Command/DOD

TECOM - U.S. Army Test and Evaluation Command/DOD

TSC - Transportation Systems Center/DOT

UMTA - Urban Mass Transportation Administration/DOT

USA - Department of the Army/DOD

USAF - Department of the Air Force/DOD

USDA - U.S. Department of Agriculture

USN - Department of the Navy/DOD

V/STOL - Vertical/Short Take Off and Landing

VTOL - Vertical Take Off and Landing

WES - Army Corp of Engineer Waterway Experiment Station/DOD

APPENDIX B

EPA PLAN TO COORDINATE THE FEDERAL NOISE RESEARCH AS REQUIRED BY THE NOISE CONTROL ACT OF 1972

(January, 1974)

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EPA PLAN TO COORDINATE THE FEDERAL NOISE RESEARCH
AS REQUIRED BY THE NOISE CONTROL ACT OF 1972
(January, 1974)

DISCUSSION

The Noise Control Act (NCA) of 1972 charges the Administrator of EPA with the responsibility to coordinate noise research and control programs of all Federal agencies as one of the ways to achieve the major objective of the Act which is "to promote an environment for all Americans free from noise that jeopardizes their health or welfare." All Federal agencies are required by the Act to promote this objective in carrying out the programs under their control (Sec. 4(a)). In order to develop, support and enforce standards, the Congress clearly intends that EPA make full use of ongoing Federally sponsored research, development and demonstration programs.* With proper coordination and promotion by EPA, this broad Federal effort could provide a significant portion of the technology, research, development and demonstration base required to support current and future regulatory activities. Proper coordination can also provide for more effective utilization of Federal resources committed to noise programs by ensuring that research and control activities respond to multiple needs and by identifying and eliminating unnecessary duplication.

Federal research coordination then is viewed as a major resource whereby the Agency will achieve much of its research, development and demonstration requirements. Specific products of research coordination will include the following: (1) a detailed in-depth review of all Federal noise research, development and demonstration programs for incorporation into an integrated Federal noise research program plan that is designed to provide the technology base for Agency regulatory and enforcement activities to control noise that jeopardizes the public health and welfare; (2) an identification of research and technology gaps that exist in current Federal noise programs that must be filled to support the Agency's regulatory and enforcement activities. This information is direct input to the Agency's coordination and research plans to assure that these environmental research needs are satisfied; (3) the opportunity for all agencies engaged in Federal

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* EPA also is required to review noise standards and regulations prescribed by other Agencies and to publish a periodic report on the status and progress of Federal Noise research & control activities.

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noise research to exchange information at all levels on continuing basis to promote program integration and to assure the most cost effective Federal program; (4) elimination of unnecessary duplication, overlapping, and unproductive research programs to assure more effective utilization of Federal resources; (5) research and demonstrated technology that can be used for development and support of noise standards and regulations and the necessary data base for support of Agency enforcement activities; (6) the information and data required for preparation of the Agency's Report to the President and Congress.

The Act does not specify a mechanism for coordination or a procedure to ensure full cooperation from all Federal agencies. As the Agency component charged with noise research, development, and demonstration and associated coordination responsibility, the Office of Research and Development (ORD) proposes an explicit plan to accomplish research coordination. This plan is based on the premise that Agency research and technology needs will be identified cooperatively by the Office of Noise Abatement and Control (ONAC) and ORD to be responsive to Agency regulatory and enforcement requirements. An additional premise is that research coordination will be implemented by ORD to supply a major portion of the Agency's research and development requirements and to comply with the Agency coordination role mandated by the Noise Control Act.

It is to be expected that other Federal agencies will not look with favor upon EPA's designated role as Federal program coordinator unless they can feel reasonably confident that EPA is technically capable of reviewing and understanding their programs, that EPA is not likely to act capriciously and arbitrarily in proposing program coordination, that their own expertise will be utilized in evaluating their own and related programs and that the affected agencies will have a forum for expressing their views. Cooperation of each affected agency is essential to effective coordination.

To ensure that the necessary products of coordination are obtained in a timely and efficient manner, the following plan for research coordination has been designed. The plan has several interacting components: (1) a specific mechanism for continuing interagency participation for information gathering and review, planning, interagency agreements, and problem resolution relating to noise research; (2) incorporation of information on research into the periodic reports on Federal noise programs; (3) in cooperation with ONAC on noise control programs, coordination through the Office of Management and Budget as needed; (4) EPA and interagency sponsored symposia and conferences; and (5) EPA in-house and jointly sponsored research; (6) a mechanism whereby noise program office requirements for development of standards and regulations are met in a timely and responsive manner by ORD. The

key to the coordination plan is the specific mechanism of interagency participation: This tool was designed and will be employed in recognition that products of research must be considered over the long term and that influence can be achieved best through continuing efforts to develop confidences and respect of the agencies in the coordination activities from the technical working level up through the policy level.

To implement interagency participation the ORD proposes to establish three interacting bodies: (1) an interagency noise research committee composed of high-level representatives of agencies with major programs of noise research; (2) four noise research panels for aircraft noise, surface vehicle noise, machinery noise and noise effects; and (3) ad hoc working groups to address specific problem areas.

The interagency noise research committee provides the entree and authority within the participating organization necessary to assure that the ORD has access to the agencies' program details such as projects, project objectives, funding level, future plans, etc. The high-level committee members identify and commit manpower for panels and working groups and serve as a point of voluntary receipt and adoption of EPA coordination requirements. EPA has determined that the interagency noise research committee will convene on an ad hoc basis as required as experience is being developed in research coordination. EPA may wish to formally establish this committee as a standing body in the future.

The interagency noise research committee would not be an advisory committee. It would not be responsible for the policy or development of any part of the coordination product. These responsibilities are viewed as exclusive EPA responsibilities and not delegable. This committee will be chaired by the Deputy Assistant Administrator for Environmental Engineering. As a result of its limited service, it is not expected that this committee would meet more than two to three times each year at the call of the chairman.

The noise research panels are standing bodies and are the vehicles whereby the ORD gains access to technical middle-management level expertise. Panels are to be made up of representatives of several agencies having research programs in a common area. Their functions include (1) reviewing and reporting on the status of specific technology; (2) identifying research and technology gaps; (3) identifying areas requiring detailed studies by ad hoc working groups; (4) exploring opportunities for Federal noise research integration and joint programs; and (5) serving as focal points for receiving and considering pertinent scientific and programmatic advice from and communications with other bodies such as NAS-NRC.

Ad hoc working groups undertake specific tasks as defined by the ORD coordinating staff. They provide one route of direct communication between agencies at the technical working level. The committee, panels and working groups would be made up of only Federal employees and, therefore, are not advisory groups which require approval by the Office of Management and Budget.

A fourth support mechanism to be employed by the ORD coordination staff in carrying out the research coordination task is the use of a contractor. This is necessary in order to handle the large volume of detailed information involved in continuing review of Federal noise research, development and demonstration programs. Contractors will be selected on a periodic basis according to specific needs to complement and to extend the scope of the technical expertise of the coordination staff.

Several specific needs have been identified that require consideration by the agencies to carry out the interagency research coordination plan. First, each agency needs to designate the appropriate members of their organizations to serve on the noise research panels. Guidelines are presented in the following paragraphs for organization of the four panels. In considering panel size and distribution of members by agency, an attempt has been made to keep each panel to a manageable size, yet to allow for adequate representation by each agency. A further consideration was the recognition of exising organizational structures that provide a means for coordination. In particular, the DOT/NASA Joint Office of Noise Abatement (JONA) has been very active in promoting coordination and program integration.

The EPA/ORD plan for coordination of aircraft noise RD&D entails the organization of an interagency aircraft noise research panel which would work in parallel with the Steering Group organized by JONA. The aircraft panel would provide a formal coordination procedure for all Federal agencies involved in aircraft noise research. EPA/ORD suggests the following representation on this panel: EPA/ORD - 1 (chairman), EPA/ONAC - 1, DOT/NASA JONA - 5, and DOD - 3. EPA/ORD feels that this distribution of agency members will adequately tie together the majority of all aircraft noise technology research being conducted by the Federal Government and believes that this approach can serve to build on existing coordination efforts. The responsibilities, purview and rules of procedure for the panels will not be presented in detail here but will be considered in the first panel meeting.

The majority of identified research and development on surface vehicle sources of noise is conducted through the DOT. The following suggestion of membership distribution for the surface vehicle noise research panel accounts for this observation: EPA/ORD - 1 (chairman), EPA/ONAC - 1, DOT - 5, DOD - 1, DOC/NBS - 1, and HUD - 1. The problem of land-use planning in relation to noise research coordination will be within the purview of this panel. It is realized that this problem transcends all areas of noise and the panel will take this into account in its activities. The noise sources considered by the panel includes all surface vehicles including those used in transportation, recreation, construction, agriculture, etc.

The interagency noise effects panel is to be concerned with the physiological and psychological response of humans to noise both collectively and individually and the effects of noise on domestic animals and wildlife. This area of noise research is probably the least coordinated with respect to overall program direction and agencies included. The following membership suggestion accounts for this: EPA/ORD - 2 (chairman), EPA/ONAC - 1, HEW - 3, DOD - 1, DOT - 1, NASA - 1, HUD - 1, DOC/NBS - 1. This panel will have responsibility for coordinating all effects research including effects on humans and domestic animals, measurement methodologies, prediction techniques, exposure criteria in the home, community, recreational areas and work place for all sources of noise.

The final panel to be organized is the interagency machinery noise research panel. This panel is to be concerned with all sources of noise not considered by the aircraft and surface vehicle panels. In particular, it includes home equipment (inside and outside), construction equipment, industrial and manufacturing machinery and equipment, and agricultural equipment not included in the surface vehicle panel. The following representation on this panel is suggested: EPA/ORD - 1 (chairman), EPA/ONAC - 1, DOC/NBS - 1, HEW/NIOSH - 1, NSF - 1, DOT - 1, DOD - 2, USDA - 1, and DOL - 1 (ex officio).

It is recognized that the agencies whose cooperation and participation are being solicited by EPA for the research coordination program may have ideas on representation and membership distribution that differ from suggestions made by EPA/ORD. ORD encourages the agencies to forward their suggestions on coordination when submitting panel member designation.

EPA/ORD envisions specific needs of the participating agencies that may not be fulfilled by panel members. For this reason it would be helpful if the agencies would designate one or more research coordination contacts. These contacts should have knowledge of and access to

agency program plans, funding data, future plans, etc. While it is desirable to minimize the number of such contacts from each agency, it is realized that it may not be practical for some agencies to employ a single contact. The need to be fulfilled is that all agency components dealing in noise research programs be covered by the agency contacts.

APPENDIX C

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APPENDIX D

INFORMATION REQUESTED BY EPA

ON THE FEDERAL NOISE RD&D PROGRAMS AND PROJECTS

INFORMATION REQUESTED BY EPA
ON THE FEDERAL NOISE RD&D PROGRAMS AND PROJECTS

INSTRUCTIONS

The objectives of this information-gathering document is to assemble the data necessary to describe the overall efforts within the Federal Government dealing with noise research, development and demonstration programs. The results will be used as a portion of the EPA report to the President and Congress on the status of Federal noise programs and to aid in coordination of Federal noise research efforts within Government agencies. The process is dynamic requiring that the data base be updated periodically to reflect changes in efforts, emphasis, expenditure of funds or completion of programs or projects.

The information requested on noise related programs and projects deal with the following areas:

- Program (project) description.
- Technical goals and achievements.
- Financial and manpower resources devoted and required.
- Facilities used or required.
- Key personnel.

The enclosed questionnaire is designed to reflect, as clearly as possible, the type of information required, but is not intended as a rigid format; hence, any agency forms that will furnish the required information easier than the questionnaire should be used by all means. If the questionnaire is used, notice should be made that:

1. Additional sheets may be used, and are encouraged, to furnish more details if the space provided is not adequate.

2. There is always a risk of not supplying enough information for the desired visibility of any program (project), but there is no risk of giving too lengthy information because this can easily be adapted to the overall report intensity or detail.

3. If the questionnaire forms miss entire aspects of program information, it is encouraged, in fact necessary, that you add these aspects under additional proper titles.

4. If your agency has a documented (or computer-stored) plan-program-project outlay with the required information, it is strongly urged that it be included in the response.

5. The program (project) information supplied should reflect actual FY 73 funding, allocated FY 74 and projections for FY 75 and later years.

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6. For programs (projects) in which noise is only a part or a consideration it is requested that information should be given on:

   A. Program (project) specifics as outlined in the questionnaire.

   B. Additional statement on the relationship of the noise-related effort to the overall scope of the program (project).

7. Finally, for any desired clarification of questions on this document, please call Dr. Eugene E. Berkau of the EPA at 202-755-0449.

The response to this questionnaire is requested by April 19, 1974.

Definitions in Responding
to the Form Titled

"FEDERAL NOISE RD&D PROGRAM SUMMARY"

Item	Remarks
1. Program Title	The formal agency title of record.
2. Agency Program Number	The formal number of record; if programs are not numbered, write 'none'.
3. Agency or Department	Parent organization (e.g., DOT, DHEW).
4. Interagency Agreements in Effect	Identify other agencies or departments participating in the program and a brief description of their tasks.
5. Subdivision Directing Work	Organizational element where program responsibility exists (NIOSH/Physical Agent Branch) Name of Head.
6. Other Key Personnel	Additional leading personnel involved in administrative or technical management of overall program.
7. Principal Contractors	Identify contractors doing work for agency at the program (not the project) level.
8. Technical Program Goals	Those considered environmental goals, like quieting a specific machine by 10 dB or improving the reliability and sensitivity of needed instrumentation systems.
9. Method of Approach	Plans or methodology for achieving program objectives.
10. Problem Areas	Identified technical, funding, and/or facilities problems.
11. Total Resource Allocation	
• Funding	The level of program funding devoted

Item	Remarks
	to noise RD&D distributed with time.
• Man-Years	The level of program manpower resources devoted to noise RD&D distributed with time.
12. Component Projects	A list of descriptive titles of those noise related projects within this program.
13. Schedules and Milestones	Show the current schedule and milestones; the "revised" column is for future use.
14. Principal Accomplishments	State achievements accomplished or within reach.
15. Program Reports, Etc.	Confine this to those stemming from the overall program rather than the individual project. Include proceedings of symposia and conferences and papers in the professional literature as well as project reports and documents.

Note: A Federal noise RD&D program includes each program in which noise is a significant (one or more projects), identifiable program element.

Environmental Protection Agency Office of Research and Development FEDERAL NOISE RD&D PROGRAM SUMMARY		
LEAD AGENCY	Agency or Department	
	Subdivision Directing Program/Head's Name, Title and Address	
	Name, Title, Address of Program Manager	
	Names and Titles of Other Key Program Personnel	
Cooperating Agency or Department and Subdivision (if any)		
Program Contractor or Grantee (if any)		
Program Title		Agency Program Number
Authority (e.g., Public Laws, Agency/ Department Directives, etc.)		Date This Form is Filled
Date of Program Start	Scheduled Date of Program Completion	

Check Appropriate Classification(s) of Program

☐ Research ☐ Development ☐ Demonstration

☐ Operations Research and/or Economic Benefit ☐ Other (Describe)

Program General Objectives:

Program Specific Goals:

Planned Approach: (Attach additional sheets if necessary)

Problem Areas:

Total Resource Allocation	Fiscal Year	Cumulative through FY 72	Actual FY 73	Allocated FY 74	Projected FY 75	FY 76	FY 77	FY 78	FY 79
	Funding $Thousand								
	Man-Years								

Program Schedules and Milestones (Detailed schedules and milestones may also be cited and appended to this response.)	Status		
Milestone	Scheduled Completion Date	Date Completed	Date or Revised

Agency/Project No.	Component Projects Descriptive/Project Title	Project Manager

Principal Accomplishments to Date (Include accomplishments relative to program goals or attained from combined project achievements)

Program Reports, Documents and Papers Published to Date: (List items attributed to the program. Complete bibliographic reference is desired/author, title, date, agency, document.)

APPENDIX E

FEDERALLY SPONSORED NOISE MEASUREMENTS RELATED RD&D

List of Tables

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E-3	Federal Machinery Noise Measurements RD&D	130

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Table E-1

FEDERAL NOISE EFFECTS MEASUREMENTS RD&D

Sponsoring Agency	Description Title	Fiscal Year Funding (Thousands of Dollars) 1973	1974	1975
HEW/NIOSH	Industrial Audiometic & Hearing Conservation Technology	31	52	80
	Measurement of Occupational Noise	32	44	28
	Subtotal	(63)	(96)	(108)
DOD	Psychoacoustical Problems in Army Aviation	85	195	195
	Airborne Noise Criteria for Ships & Submarines	69	74	74*
	Mechanisms of Noise Generation & Reception	3	2	2*
	Bioacoustic Environments	92	68	68*
	Bioenvironmental Noise	43		
	Air Force Land Use Planning Procedure-Aircraft Noise			
	Aircraft Noise Environments	13	15	15*
	Prediction & Reduction of Noise Impact		250	260
	Subtotal	(337)	(604)	(614)

*Estimated

Table E-1

FEDERAL NOISE EFFECTS MEASUREMENTS RD&D
(Concluded)

Sponsoring Agency	Description Title	Fiscal Year Funding (Thousands of Dollars) 1973	1974	1975
HUD	HUD Urban Noise Measurement System	117	263	
	Development of Noise Attenuation Measures		175	50
	Subtotal	(117)	(438)	(50)
NASA	Characterization of V/STOL Noises	532	409	404
	Subtotal	(532)	(409)	(404)
EPA	Instrumentation & Measurement Systems for Noise Exposure of Individuals	24	32	-
	Subtotal	(24)	(32)	(-)
DOI/BuMines	Portable Calibration Instruction for Audiodosimeters - Feasibility Study	-	15	-
	Subtotal	(-)	(15)	(-)
	Grand Total	1,073	1,594	1,176

Table E-2

FEDERAL SURFACE VEHICLE NOISE MEASUREMENTS RD&D

Sponsoring Agency	Description Title		Fiscal Year Funding (Thousands of Dollars) 1973	1974 (est.)	1975*
DOT	Highway Noise Enforcement Training & Equipment		450	70	-
	Roadside Enforcement Sites		-	100	50
	Measurement of Railroad Noise		+	-	-
		Subtotal	(450)	(170)	(50)
EPA	Interstate Rail Carriers		23	-	-
	New Medium- & Heavy-Duty Trucks		-	12	-
		Subtotal	(23)	(12)	(-)
DOD	Operator Noise Exposure		44	+	-
		Subtotal	(44)	(-)	(-)
		Grand Total	517	182	50

\+ Primarily In-house

* FY75 Estimates Known to be Incomplete

Table E-3

FEDERAL MACHINERY NOISE MEASUREMENTS RD&D

Sponsoring Agency	Description Title	Fiscal Year Funding (Thousands of Dollars) 1973	1974	1975
NBS	Assessment of Measurement Standards for Determination of Sound Power	41	120	120
	Subtotal	(41)	(120)	(120)
DOI/BuMines	Definition & Correction of Noise in Coal Mines	100	137	-
	Noise Control in Surface Mining Facilities-Problem Definition	79	17	-
	Subtotal	(179)	(154)	(-)
CPSC	Developing a Consistent Set of Product Noise Regulations	-	20	-
	Noise Measurement Techniques for Toys	-	35	-
	Test Protocol for Lawnmower Noise	-	15	-
	Subtotal	(-)	(70)	(-)

Table E-3

FEDERAL MACHINERY NOISE MEASUREMENTS RD&D
(Continued)

Sponsoring Agency	Description Title	Fiscal Year Funding (Thousands of Dollars) 1973	1974	1975
DOD	Noise Criteria[1]			
	Construction Noise: Specification and Control	-	40	45
	Subtotal	(-)	(40)	(45)
EPA	Development of Noise Measurement Methodologies for Portable Air Compressors	60	64	-
	Subtotal	(60)	(64)	(-)
USDA	Abatement and Control of Noise Associated with Agricultural Processes	0	20	92
	Subtotal	(0)	(20)	(92)
NSF	Prediction of Noise Levels in Manufacturing Areas	-	39	-
	Subtotal	(-)	(39)	(-)

Table E-3

FEDERAL MACHINERY NOISE MEASUREMENTS RD&D
(Concluded)

Sponsoring Agency	Description Title	Fiscal Year Funding (Thousands of Dollars) 1973	1974	1975
HEW/NIOSH	Impulse Noise Recording System[2]	-	-	-
	Grand Total	280	507	257

[1] Classified Project

[2] Nominal In-house Funding

ADDENDUM

Special auxiliary equipment on trucks, such as refrigeration units and solid waste compactors, is being considered by EPA as a major noise source. This source was inadvertently omitted from consideration in the analysis. However, no Federal noise RD&D was identified which specifically addresses special auxiliary equipment on trucks. Some of the Federal machinery noise RD&D on air conditioners and hydraulic systems may be applicable.